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By-Pinnell, Charles; Wacholder, Michael

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The fourth of a five-volume series concerned with higher educational planning provides techniques for the estimation of an institution's facility requirements. The facilities are discussed within the framework of two broad categories--(1) academic program facilities, and (2) residential housing facilities. The academic program facilities provide for classrooms, laboratories, offices, recreational facilities and other associated space as required to conduct the program of a university. The residential housing facilities provide for student housing and in some cases faculty and staff housing. Planning for the academic facilities requires an inventory of existing facilities including a quality analysis, facility utilization research, and estimations of space requirements for both teaching and non-teaching facilities. The aspects of an automated system of master schedule construction and student sectioning are briefly presented. Residential facilities planning is based on a thorough analysis of the student body based on marital status, number of dependents, sex, and college year. Numerous formulas and specific numerical values are supplied as part of the recommended techniques involved in estimation. An appendix includes quality analysis worksheets and housing guidelines. (NI)

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VOLUME FOUR

GUIDELINES FOR PLANNING [redacted] ITIES

PHYSICAL PLANT PLANNING
FACILITIES STUDIES

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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GUIDELINES FOR PLANNING IN COLLEGES AND UNIVERSITIES

VOLUME FOUR • PHYSICAL PLANT PLANNING FACILITIES STUDIES

Report Developed For

THE COORDINATING BOARD • TEXAS COLLEGE AND UNIVERSITY SYSTEM

By
Dr. Charles Pinnell • Project Director
Mr. Michael Wacholder • Associate Project Director

Mr. James Blakesley, Mr. Charles Sherwood and Associates • Purdue University
Consultants

Texas A&M University • July 1968

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In creating the Coordinating Board, Texas College and University System, the 59th Texas Legislature directed the Board to "require and assist the public senior colleges and universities, medical and dental units, and other agencies of higher education in developing long-range plans for campus development."

An early step by the Coordinating Board in carrying out this legal mandate was to conduct a statewide survey of the status of institutional master planning in Texas. In January, 1967, the Board published a report indicating that many colleges and universities in the State did not have master plans which could be considered comprehensive in scope.

As a result, the Coordinating Board entered into a contract with Texas A&M University to prepare a model system for planning in colleges and universities. The volumes which make up the "Guidelines for Planning in Colleges and Universities" are the product of this contracted project.

Student enrollment in Texas colleges and universities will increase rapidly and dramatically during the next decade, and the importance of sound planning cannot be too strongly emphasized.

The process of planning described in these volumes focuses on the creation of a system to permit institutions to identify that which is innovative and unique about their educational program and objectives and to plan in depth within the context of their institutional objectives. Master planning is conceived in these volumes as encompassing the total decision-making framework of the institution. Under such a condition, an institutional master plan becomes a complex document in which the design and location of buildings is but one of the components.

The distribution of these "Guidelines for Planning in Colleges and Universities" by the Coordinating Board is not intended to standardize all planning procedures in Texas higher education or to force colleges and universities into a lockstep approach, physically or otherwise. Rather, the purpose of the volumes is to provide to both public and private institutions illustrations and suggested approaches. We ask that the volumes be accepted in this context.

The Coordinating Board staff expresses deep appreciation to Dr. Charles Pinnell, Michael H. Wacholder, and other members of the research staff at Texas A&M University for the work they applied directly to this study and the direction they gave to the consultants providing assistance to them.

J. K. Williams
Commissioner

ACKNOWLEDGEMENTS

The research and development work that has gone into the preparation of "Guidelines for Planning in College and Universities" has been a most challenging and rewarding experience. The staff members of this study are sincerely grateful for the opportunity to have worked on the project and wish to express their gratitude to those who made it possible.

First, our thanks are extended to the Coordinating Board, Texas College and University System, for sponsoring this research project. The group, under the direction of Dr. Jack K. Williams, is providing significant leadership to higher education in Texas, and we are proud to have been associated with their work. Mr. Kenneth H. Ashworth, Assistant Commissioner for Federal Programs and Facilities Planning and Mr. William J. Martin, Director of Facilities Planning of the Coordinating Board Staff provided support and assistance in all aspects of the study and contributed significantly to the research effort.

Sincere appreciation is expressed to President Earl Rudder and Vice-President Wayne C. Hall of Texas A&M University for their support of this project. Many facets of the planning system were developed and tested utilizing data, staff, and facilities of Texas A&M University. The availability of this real-life laboratory contributed greatly to the research and development effort, and we are extremely grateful for the support and cooperation obtained at all administrative levels.

This study was financed from funds provided by the Coordinating Board, Texas College and University System, the U.S. Office of Education, and Texas A&M University. Appreciation is expressed to these agencies for their support.

Finally, numerous members of the faculty and staff at Texas A&M University have provided guidance and assistance to this project, and this contribution is gratefully acknowledged.

Dr. Charles Pinnell
Project Director

PROJECT STAFF

CHARLES PINNELL - Project Director
B.S., Civil Engineering, Texas Technological College, 1952;
M.S., Civil Engineering, Purdue University, 1958;
Ph.D., Management and Engineering Science, Northwestern University and Texas A&M University, 1964.

MICHAEL H. WACHOLDER - Associate Project Director
B.S., Landscape Architecture, University of California at Berkeley, 1965;
M.S., Urban Planning, Texas A&M University, 1968.

LESTER WOOD - Computer Systems for Space Utilization and Reporting
B.A., Mathematics, Texas A&M University, 1959;
M.S., Computer Science, Texas A&M University, 1968.

ELLIOTT BRAY - Automated Scheduling of Teaching Facilities, Management Information Systems
B.S., Mathematics, Lamar State College of Technology, 1962;
M.S., Computer Science, Texas A&M University, 1967.

MEL H. LASELL - Facilities Reporting, Management Planning
B.A., Business Administration, Texas A&M University, 1967;
M.S., Management, Texas A&M University, 1968.

JOHN F. REGLIN - Traffic Planning
B.S., Civil Engineering, University of Texas at Arlington, 1967;
M.S., Civil Engineering, Texas A&M University, 1968.

ROBERT DUNPHY - Traffic Planning
B.S., Civil Engineering, Catholic University, 1965;
M.S., Civil Engineering, Texas A&M University.

ROBERT BRADLEY - Quality Analysis for Facilities
B.S., Building Construction, Trinity University, 1966;
M.S., Urban Planning, Texas A&M University, 1968.

RAY ABBOTT - Physical Plant Planning and Publications
B. Arch., Texas A&M University, 1966;
M.S., Urban Planning, Texas A&M University, 1968.

JOE DAVIS - Space Utilization, Management Planning
B.S., Industrial Technology, Texas A&M University, 1967;
M.S., Computer Science, Texas A&M University, 1968.

SUPPORTING PERSONNEL

DR. VERGIL STOVER

PROFESSOR JAMES GARDNER

CLIFF GUILLETT

DAVID KEATING

RONALD PERRY

MRS. PAM ROWE

MRS. LYNN WILLIAMS

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FOREWORD

This volume will provide techniques for estimating the facility requirements of an institution. Numerous formulas and specific numerical values are given as a part of the recommended techniques. This was necessary to provide a workable and meaningful procedure. It should be noted, however, that systematic procedures for insitutional planning are in their infancy and the numerical values suggested in this volume are necessarily based on limited research.

Therefore, it is highly recommended that the user of this material study and develop an understanding of the overall process that is involved. With such an understanding, it will be possible to better adjust the planning process to individual institutions and to introduce the results of additional research into the process as these results become available.

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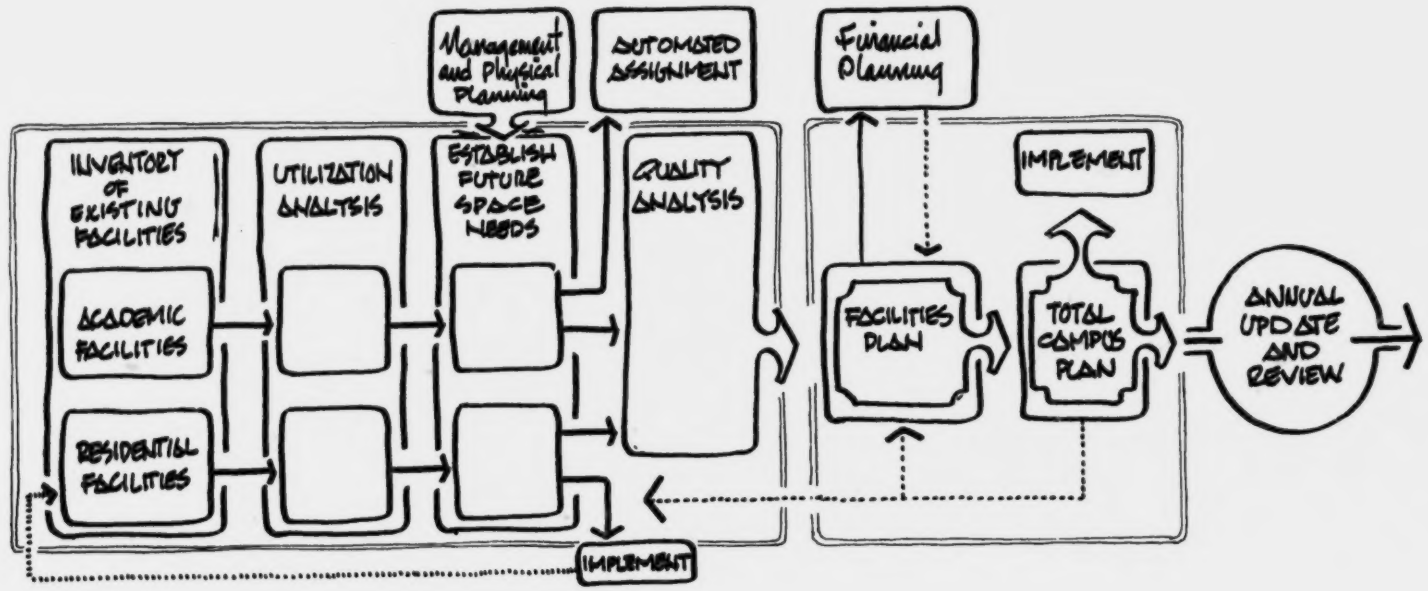
INTRODUCTION



Facilities as defined in this report are the buildings which must be provided by a given university in order to conduct the various aspects of its program. These facilities will be discussed within two broad categories which are:

(1) Academic Program Facilities, and

(2) Residential Housing Facilities.

The Academic Program Facilities provide for classrooms, laboratories, offices, recreational facilities, and other associated space as required to conduct the programs of a university. The Residential Housing Facilities provide for student housing, and in some cases faculty-staff housing.

The preparation of a complete facilities plan requires extensive data collection and analysis. The basic requirement of facilities planning is to establish long-range needs for facilities, examine and evaluate the utilization and condition of existing facilities, and formulate specific plans for providing projected requirements. As discussed in Volume I, these plans may include better utilization of existing space, modification of existing facilities, and construction of new facilities.

REQUIRED STUDIES

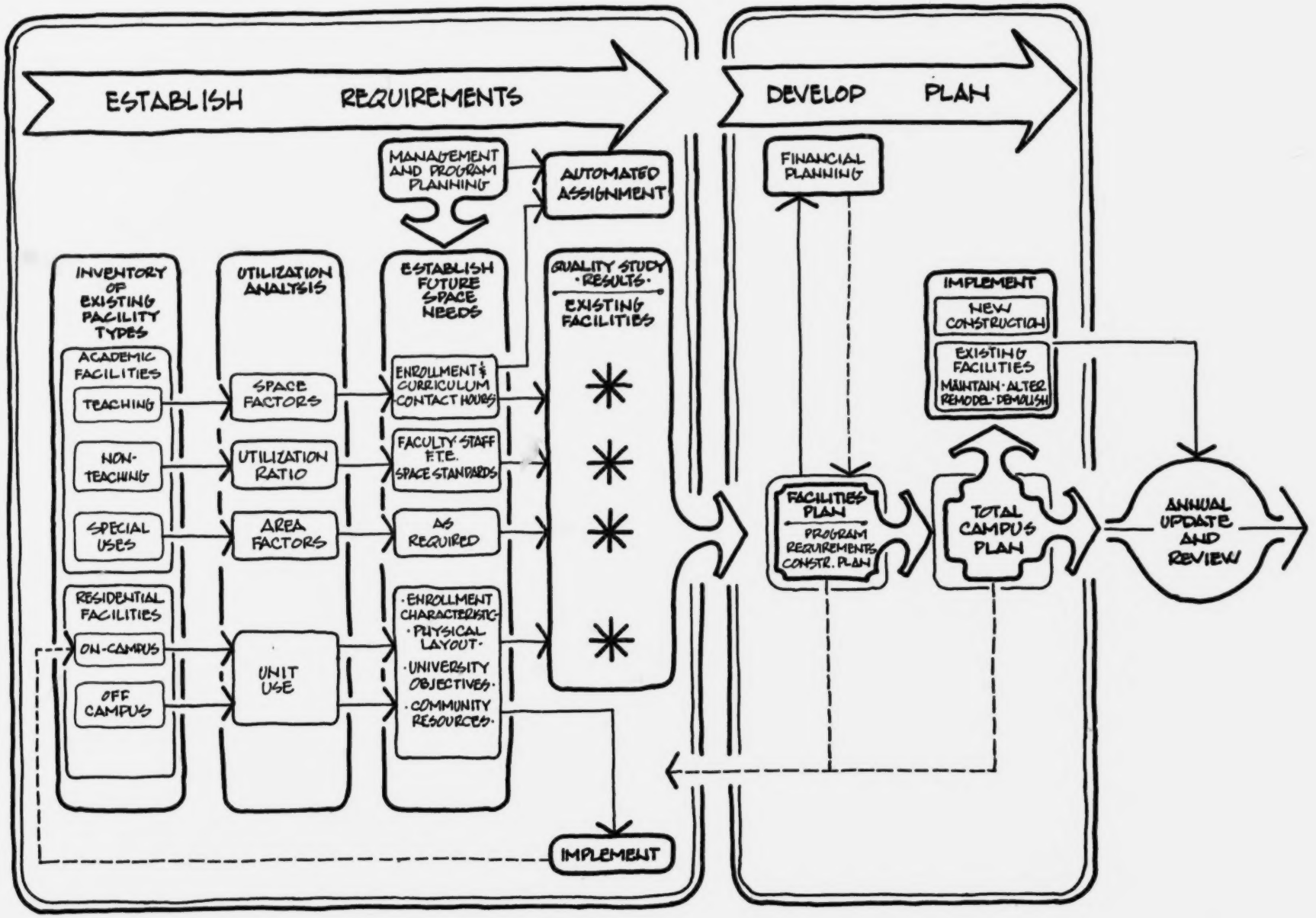
A number of detailed studies are necessary to develop desired information upon which to base an effective facilities plan. The studies basic to this process are identified as follows:

(1) Inventory of Existing Facilities - A building-by-building and room-by-room inventory of existing facilities.
(2) Utilization of Teaching Facilities - Study and evaluation of existing utilization of classrooms and laboratories.
(3) Utilization of Non-Teaching Facilities - Study of present use and requirements for offices, research laboratories, public service facilities and other general academic requirements.
(4) Estimation of Space Needs - Development of techniques for estimating future space needs.
(5) Automated Assignment of Teaching Facilities - Consideration of computer techniques for assigning teaching facilities.
(6) Quality Study of Existing Space - Building-by-building analysis to examine the condition of existing facilities.
(7) Residential Housing Study - Development of data on the present and future demand for residential housing by students, faculty, and staff.

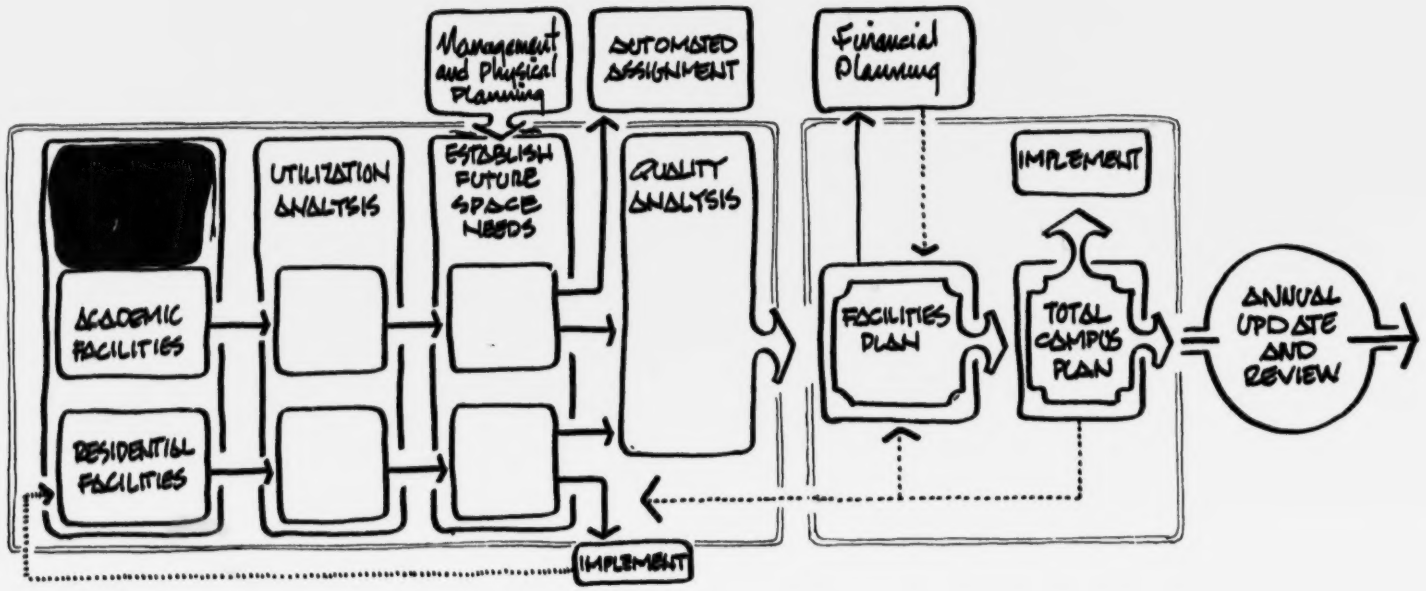
PRESENTATION

The studies indicated in the previous material are vital to proper facilities planning and this volume will concentrate on suggesting techniques for conducting each study. Each of the studies will be given singular consideration in separate sections of this volume. Figure I provides a graphic illustration of the total facilities planning process that will be discussed. This illustration will be utilized throughout this volume to remind the reader of the total process and to assist him in relating the material in the various sections of the report to the total facilities planning process.

FIGURE 1 · FACILITIES PLANNING PROCESS



INVENTORY OF EXISTING FACILITIES



REQUIREMENTS

A basic necessity for any facilities study is a good inventory of existing facilities. The requirements for an inventory of facilities can be expressed in terms of two major categories which are:

(1) Buildings, and

(2) Rooms Within Buildings.

The Office of Education of the Department of Health, Education, and Welfare has developed a manual entitled "Higher Education Facilities Classification And Inventory Procedures Manual" which is recommended as a basic guide for developing a facilities inventory. This manual lists the basic data required for each of the above categories. These data requirements are indicated as follows:

BUILDING DATA

Necessary	Optional
Building Number	Building Name
Gross Square Feet	Assignable Square Feet
Actual Capital Investment	Custodial Square Feet
Estimated Replacement Value	Circulation Square Feet
Ownership	Mechanical Square Feet
Date of Initial Occupancy	Construction Square Feet
Condition	Construction Cost
Source of Funds	Furnishings Cost
Institutional Identification	Other Project Costs

ROOM DATA

Necessary	Optional
Building Number	Building Name
Room Number	Room Dimensions
Assignable Square Feet	Organizational Unit - Institutional Code
Organizational Unit - Standard Code	Type of Room - Institutional Code
Type of Room - Standard Code	Function - Institutional Code
Function - Standard Code	
Number of Stations - Teaching Facilities	
Institutional Identification	

It is helpful to also include a Room Description as a necessary room data item. This description such as "Freshman Chemistry Lab", "Faculty Office", etc., is very helpful internally. Also, the number of stations can be identified relative to offices, if desired.

When the above items are obtained for each building and every room of each building on the campus of an institution, a body of data exists which will be extremely valuable for a number of purposes and basic to the space utilization studies which will be developed in this report.

It should be noted that in the list of desired data some items are considered necessary and some items are indicated as optional to the individual institution. The data to be collected is also dependent upon the institution's requirements and the requirements for State and National reporting. The space management and utilization studies discussed in this volume, may identify some additional requirements that individual institutions may wish to consider.

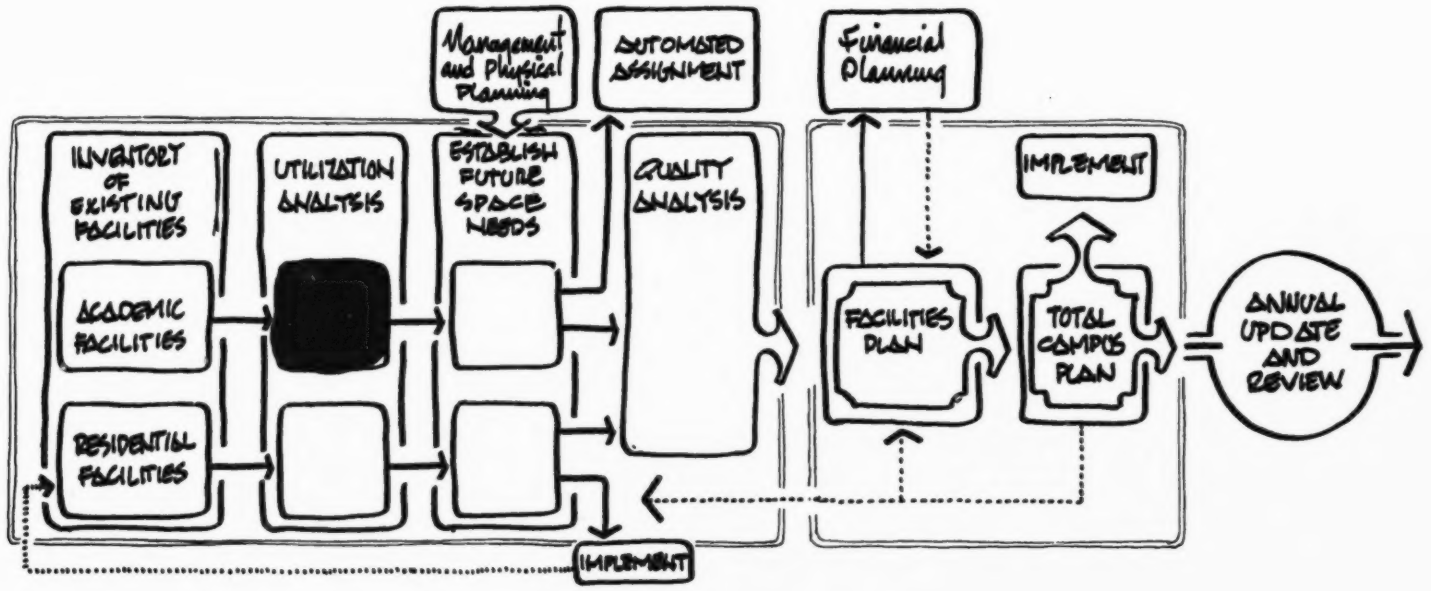
PROCEDURES

A basic consideration in conducting a facilities inventory is to utilize a system of data collection and classification that will provide uniformity with other similar agencies. As previously noted, the Office of Education of the U. S. Department of Health, Education, and Welfare has developed an excellent manual of facilities classification and inventory procedures and it is recommended that this manual be followed in completing an inventory study. The procedures and classification outlined in the manual will provide the desired uniformity and permit an institution to respond to reporting demands at the local, state, and national level.

A unique number must be assigned to each building and to each room of every building. This permits the specific identification of any room on the campus of an institution. It is also necessary that all of the rooms bear an easily read number as assigned in the inventory system. This permits specific identification of a given room by a user and provides assurance that the room is correctly designated in the inventory.

A system of continuous updating of the inventory is also vital. This permits new facilities to be added to the inventory as well as modifications in the use or arrangement of existing rooms. Without an adequate updating system the inventory will be outdated within a few years.

UTILIZATION OF TEACHING FACILITIES



The utilization and management of space will be discussed in two separate categories which are: (1) Teaching Facilities and (2) Non-Teaching Facilities, the former being discussed in this section and the latter in the following section.

CONSIDERATIONS

In this report, the category of Teaching Facilities will include the following:

(1) Classrooms
(2) Seminar Rooms
(3) Lecture Rooms
(4) Teaching Auditoriums
(5) Teaching Service Rooms
(6) Teaching Laboratories
(7) Teaching Clinics
(8) Service Areas for Teaching Laboratories
(9) Others as Required

The desired management of teaching facility space defines the need for one central office of the university to have the responsibility for space assignment and utilization reporting. This prohibits departments from "owning" certain teaching spaces that could be utilized by several departments and provides a total university approach toward space management and utilization. This responsibility should be assigned to a Planning and Analytical Studies Office as described in Volumes I and II.

UTILIZATION MEASUREMENTS · TEACHING FACILITIES

Once a central office is designated for space management, it is then necessary to develop a reporting system which will provide this office with the desired data to evaluate the utilization of teaching facilities. This reporting system should indicate present utilization and provide paramenters useful for future planning.

SPACE FACTOR

James Blakesley and Associates, at Purdue University[1] have developed the concept of a space factor that can be utilized for evaluating space utilization and predicting space requirements. This space factor is defined by three basic elements which are:

(1) Square Feet per Station (Design Element)

(2) Station Use (Design and Utilization Element)

(3) Room Use (Utilization Element)

[1] James F. Blakesley, *Composite and Elemental Space Measures*, Purdue University Publication.

The space factor for a given room is determined as follows:

$$SF = \frac{A_s \times N_s}{H_w \times U_p \times N_s} = \frac{A_s}{H_w \times U_p}$$

Where

SF = Space Factor (Square Feet/Student Contract Hour)
A_s = Area Per Station (Square Feet)
N_s = Number of Stations
U_p = Percent Station Utilization When Room Is In Use
H_w = Hours Scheduled Per Week

The number of stations (N_s) cancels out in the formula and thus it can be seen that the space factor (SF) is dependent upon the three previously listed factors (A_s, H_w, U_p).

As an example, consider a classroom that has an area per student station (A_s) of 15 square feet, is scheduled for 30 hours per week (H_w), and has a utilization rate (U_p) of 50%. This classroom would have a space factor (SF) determined as follows:

$$SF = \frac{15}{30 \times .50} = 1.0 \ \frac{\text{square feet}}{\text{student contact hour}}$$

A space factor of (1.0) might be considered a par value for classroom utilization. Values less than or equal to one (1.0) indicate good utilization and values greater than one (1.0) indicate fair to poor utilization depending on the magnitude of the space factor.

The space factor for a teaching laboratory may differ greatly from that of a general classroom. This difference can be explained by considering the three basic elements which determine the factor. In general, the area per student station is greater, the number of hours scheduled per week smaller, and the percent station utilization greater for a teaching laboratory as compared to a classroom. An example of a space factor for a laboratory is as follows:

A_s = 48 square feet
H_w = 20 hours
U_p = 60%

$$SF = \frac{48}{20 \times .60} = 4.0 \ \frac{\text{square feet}}{\text{student contact hour}}$$

The space factor for teaching laboratories will vary for each academic department and even for various type labs within a given department. Therefore, it is not possible to specify a par value which will be representative university wide and a factor or factors will need to be established relative to each department. The main variable is the area per student station (A_s) which may be different for each department. A range of 2.5 to 5.0 is to be expected for teaching lab space factors.

The variables of hours scheduled per week (H_w) and percent utilization (U_p) are greatly dependent upon the student demand for individual lab courses and the degree of specialization of the lab. For example a freshman chemistry lab with high student demand might be scheduled 40 hours a week with 80% utilization while a highly specialized chemistry lab for senior or graduate students might be pressed to generate 15 hours per week with 60% utilization. These differences must be recognized when examining lab utilization or when projecting future space requirements for teaching labs.

The simple formula (or model) which has been presented for space utilization indicates that improved utilization of teaching facilities can be obtained by any or a combination of the following methods:

(1) Reduction in the area per student stations (increase the number of stations per room).

(2) Increase in the number of stations used when the room is in use (provide better match of room size to class size).

(3) Increase in the number of hours scheduled per week.

Of the above three methods, numbers (2) and (3) offer the best techniques for existing schools to improve teaching facility utilization. Number (1) can be given special attention when designing new facilities or in modifying existing facilities. If class sizes are much smaller than room sizes, this situation may have resulted from a university policy to decrease student-teacher ratios i.e., reduce class sizes. In this case it may be feasible to consider the subdivision of large classrooms (50-70 seats) into two smaller classrooms (25-35 seats) to increase utilization.

An increase in the number of hours scheduled per week (H_W) is the best method of increasing the utilization of existing facilities. Longer days (8 hours to 10 hours or more) and longer weeks (use of Saturday) offer feasible means to increase utilization and provide additional teaching space.

In addition to reflecting utilization, the space factor provides an excellent parameter for predicting space requirements in teaching facilities. The number of student contact hours (SC_tH) generated by a given department, college, or university can be determined by considering the enrollment and the curriculum to be offered. Once the number of contact hours are established, they can be multiplied by an appropriate space factor to obtain required square feet of teaching facilities. For example, consider the following:

Predicted Student Contact Hours in Lecture
Per Week for the Mathematics Department = 8000 SC_tH

Space Factor for Mathematics Department for Classrooms = 0.9

Classroom Space Required = 8000 x .9 = 7200 sq. ft.

The projected need for 7200 square feet of classroom space could then be converted to indicate the actual design of the rooms by considering class sizes and other teaching constraints of the department.

REPORTING

In order to effect good management of teaching facility space, it is necessary to have a utilization report on each room. Such a utilization report should provide only the basic data necessary to evaluate the utilization of a given room. The report should readily indicate if good utilization is being obtained, and, if not, the report should provide data to indicate why the utilization is less than desired.

ROOM UTILIZATION REPORT

The space factor and its associated elements (A_s, H_w, U_p) are the basic data that are needed for the evaluation of teaching facility utilization. Thus, it is recommended that a report of the type shown in Figure 2 be obtained for each classroom or laboratory at an institution during each semester.

FIGURE 2 · CLASSROOM UTILIZATION REPORT

TEACHING FACILITIES ROOM UTILIZATION REPORT
FALL SEMESTER 1968
RUN DATE 10-20-68

BLDG. 0462 - ACADEMIC

ROOM NO.	TYPE ROOM	STUDENT STATIONS	NET RM AREA	AREA PER STU. STA.	HRS SCHED PER WEEK	STU STA HRS SCHED/WEEK	PERC. USAGE WHEN IN USE	SQ. FT. PER STU. CONTACT HR.
100	201	36	660	18.3	37	837	62.8	0.8
123	201	28	660	23.6	35	639	65.2	1.0
125	201	32	660	20.6	30	798	83.1	0.8
127	201	45	660	14.7	31	928	66.5	0.7
204	201	34	660	19.4	28	568	59.7	1.2
205	201	45	660	14.7	28	836	66.3	0.8
303	201	48	606	12.6	33	930	58.7	0.7
327	201	30	660	22.0	19	512	89.8	1.3
401	201	35	1395	39.9	32	879	78.5	1.6
404	201	40	678	17.0	21	594	70.7	1.1
AVG. - GEN. CLASSROOMS		37	730	19.6	29	752	68.6	1.0
206	203	25	1260	50.4	16	381	95.3	3.3
207	203	25	1395	55.8	21	423	80.6	3.3
210	203	25	4050	162.0	22	528	96.0	7.7
307	203	25	1395	55.8	18	438	97.3	3.2
406	203	38	678	17.8	10	362	95.3	1.9
AVG. - LABS.		28	1756	63.6	17	426	88.8	4.1
110	205	186	2000	10.8	25	951	20.5	2.1
213	205	100	1210	12.1	27	1700	63.0	0.7
402	205	73	1012	13.9	30	1625	74.2	0.6
AVG. - LECTURE ROOMS		120	1407	11.8	27	1425	43.6	1.0

This report can be prepared manually for a small institution with a few classrooms or automatically on a computer in the case of a large institution with hundreds of classrooms and labs. It provides an exception-type report that permits rapid identification of rooms that are poorly utilized and also provides values for (A_s), (H_w), and (U_p) that indicate why the utilization is less than desired. For an example, note calssroom number 327 in the report shown in Figure 2. This room has a space factor (SF) of 1.3 which indicates poor utilization. The value of (A_s) is 22.0 which is high, (U_p) is 89.8% which is good, and (H_w) has a value of 19 (which shows that the room is only used 19 hours a week). The high value of (A_s) plus the low value of (H_w) would account for the less than desirable utilization.

SUPPLEMENTARY REPORTING

Although the room utilization report previously described and illustrated provides basic data for space management, some additional reports may be helpful for further analysis of teaching facility utilization and management. Suggested supplementary reports are described as follows:

Room Size vs Class Size - Poor utilization can result from a low percent utilization of classroom or lab stations. This low utilization can result from the scheduling process where room size and class size are poorly matched or from the general design of the teaching facilities where the classrooms or labs provided are much larger than required. It is thus desirable to have an indication of the magnitude of this problem so that scheduling can be improved or design can be modified. A suggested report for this purpose is shown in Figure 3. This report clearly and quickly indicates the present match of class size and room size.

For example, in Figure 3 the data indicate that 83 classes of size 0-9 are meeting in rooms which seat 40-49 students. This results in a low value for (U_p) and a high space factor (SF). A good "mix" of classroom sizes and good scheduling provides a means for correcting this problem.

FIGURE 3 · ROOM SIZE VS CLASS SIZE MATRIX

ROOM SIZE VERSUS CLASS SIZE MATRIX
FALL SEMESTER 1968

GEN. CLASSROOMS

ROOM SIZE \ CLASS SIZE	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	TOTAL
0- 9	*								
10- 19	3	*							3
20- 29	30	44	26*						100
30- 39	114	115	181	107*					517
40- 49	83	88	149	132	53*				505
50- 59	19	10	48	49	24	6*			156
60- 69	4	1	6	6	3	1	3*		24
70- 79	7	8	5	12	14	10	6	2*	64
TOTAL	260	266	415	306	94	17	9	2	1369

NOTE - NUMBERS REPRESENT NUMBER OF CLASSES.

Distribution of Teaching Schedule - Another report which may be of value in considering the overall scheduling of teaching facilities is illustrated in Figure 4. This report indicates the number of students in class during any hour of the week. It indicates the degree to which a uniform distribution of students attending class over the hours of the week has been obtained in the scheduling process. It must be noted, however, that even though students have been scheduled evenly over the week, various types of teaching facilities may have non-uniform use. For example, lecture rooms may be scheduled heavy on Mondays but light other days of the week or classrooms may be utilized heavily on Mondays, Wednesdays and Fridays, but light on Tuesdays and Thursdays.

Room Schedules - It will also be helpful to have a ready reference to the actual use of any room. Figure 5 illustrates a room schedule which provides data on the hours the room is utilized, the courses being taught and the number of students in the room at any time.

FIGURE 4 · DISTRIBUTION OF STUDENTS IN CLASS

CLASS ATTENDANCE DISTRIBUTION
FALL SEMESTER 1968

NUMBER OF STUDENTS IN CLASS FOR EACH HOUR OF DAY

HOUR	MON	TUES	WEDS	THURS	FRI	SAT
8	5374	5336	5691	5031	4999	402
9	6194	5359	6074	5219	5614	435
10	6073	5686	6212	5100	5663	331
11	5776	5247	5803	5141	4832	214
12	529	72	508	80	409	
1	5114	3372	5127	5170	4271	
2	4798	4162	5109	4994	4481	
3	5204	4322	3506	3773	2955	
4	5418	3551	3224	2322	2106	
AFTER 5 PM	719	565	922	683	99	

FIGURE 5 · ROOM SCHEDULE

CLASSROOM USAGE FALL SEMESTER 1966
BLDG. 0462 - ACADEMIC ROOM 305 NO. OF STATIONS 33 NET AREA 660
TYPE ROOM 201 - GENERAL CLASSROOM DEPARTMENT - ENGL

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
6						
7						
8	ENGL 103 - 051 30 UNG	ENGL 103 - 016 32 UNG	ENGL 103 - 051 30 UNG	ENGL 103 - 016 32 UNG	ENGL 103 - 051 30 UNG	
9	ENGL 210 - 150 32 UNG	ENGL 103 - CBND 61 UNG	ENGL 210 - 150 32 UNG	ENGL 103 - CBND 61 UNG	ENGL 210 - 150 32 UNG	
10	ENGL 104 - 070 33 UNG	ENGL 427 - 500 4 GR 12 UNG	ENGL 104 - 070 33 UNG	ENGL 427 - 500 4 GR 12 UNG	ENGL 104 - 070 33 UNG	
11	ENGL 210 - 167 30 UNG		ENGL 210 - 167 30 UNG		ENGL 210 - 167 30 UNG	
12						
1	ENGL 103 - 005 29 UNG		ENGL 103 - 005 29 UNG	ENGL 103 - 005 29 UNG	ENGL 103 - 016 32 UNG	
2	ENGL 103 - 084 29 UNG		ENGL 103 - 084 29 UNG	ENGL 103 - 084 29 UNG	ENGL 103 - 069 31 UNG	
3	ENGL 427 - 500 4 GR 12 UNG				ENGL 100 - 501 19 UNG	
4	ENGL 103 - 009 30 UNG	ENGL 614 - 600 11 GR	ENGL 614 - 600 11 GR	ENGL 614 - 600 11 GR		
5		EDUC 604 - CBND 9 GR 17 UNG		EDUC 624 - CBND 13 GR 17 UNG		
6		EDUC 604 - 600 9 GR		EDUC 624 - 600 13 GR		
7		EDUC 604 - 600 9 GR				
8						
9						

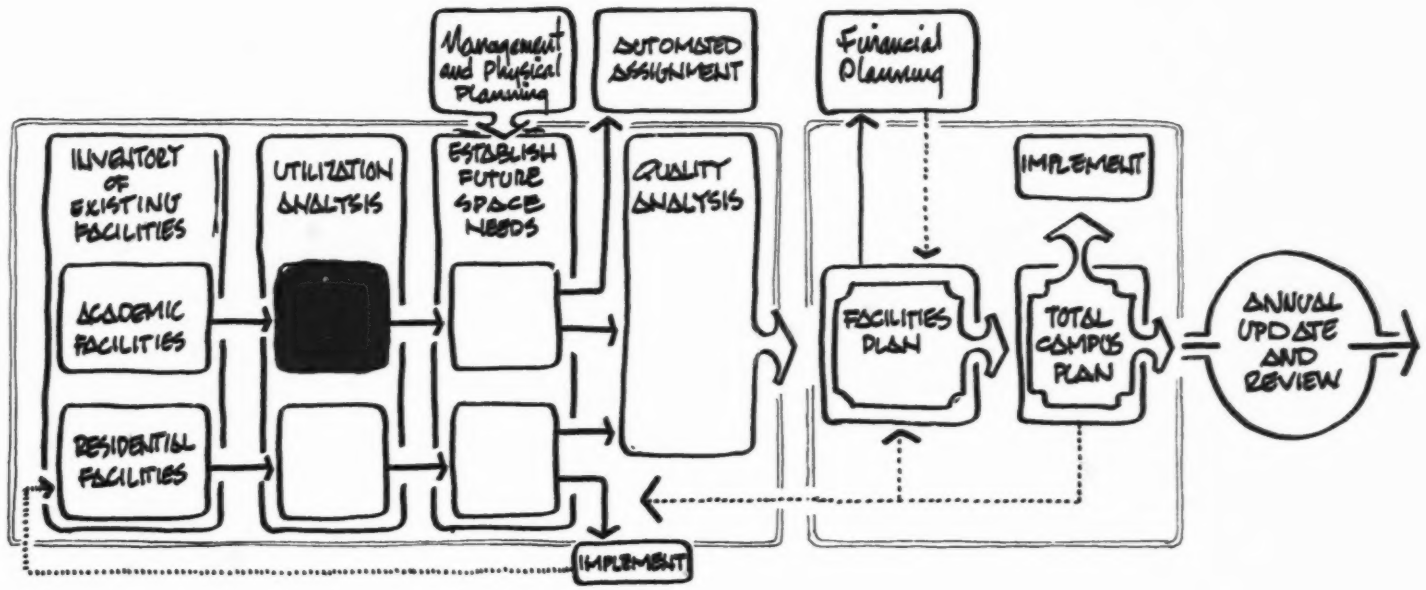
SUMMARY

Before building new teaching facilities, it is desirable to determine if existing facilities are being utilized to a desired level and if needed space could be obtained by effecting space management techniques that would provide better utilization. It was shown that the degree of utilization for a given classroom or teaching lab is dependent upon three elements which are:

(1) (A_s) - Area per Student Station
(2) (U_p) - Percent Utilization
(3) (H_w) - Hours used per week

A room utilization report providing data on each of the above elements and the composite space factor which is determined from them is recommended.

UTILIZATION OF NON-TEACHING FACILITIES



CONSIDERATIONS

Non-teaching space is defined as that space not used for conducting classes or teaching laboratory courses. It would include the following:

(1) Office Space
(2) Conference Rooms
(3) Office Service Areas
(4) Research Laboratories
(5) Work Areas
(6) Storage and Service Areas
(7) Other Similar Areas

This type of space represents the major percentage of the space of a given institution. It will be an even greater percent of the total space of an institution that has large research and public service programs. Therefore, it is also necessary that this type of space be placed under central supervision and that methods are available for evaluating its utilization.

ORGANIZATIONAL UNIT INVENTORY

The utilization of non-teaching space must be evaluated in terms of the organizational unit using the space. Thus, it is necessary to assign each room of the total university space inventory to some organizational unit. Examples of organizational units are as follows:

Academic Departments
Research Institutes
Public Service Units
Administrative Units
Registrar
Library
Physical Plants
Student Affairs
Fiscal Units
Others

The assignment of rooms to organizational units can be accomplished by assigning an institutional code to each room. This institutional code should indicate the unique organizational unit to which the room has been assigned. If the total institutional space inventory is stored on computer tape or disc, then an organizational unit inventory can be developed by distributing every room on the total inventory to the inventories of the various organizational units. An example of such an organizational unit inventory is shown in Figure 6.

The organizational unit inventory serves two major purposes which are as follows:

(1) It provides a means of checking the accuracy of the total institutional space inventory and updating this inventory at desired intervals. Each unit can be made responsible for checking the accuracy of the room inventory for that relatively small amount of space assigned for their use.

(2) It provides the means to compare the space assigned to an organizational unit to that space required by the program being conducted by the organizational unit. This permits evaluation of the space utilization of non-teaching facilities.

After the total space inventory for an institution has been developed, it should then be subdivided into organizational unit inventories. These unit inventories would then be distributed to each unit for validation. After all errors have been eliminated, then the institutional inventory and all of the organizational unit inventories would be ready for use. The organizational unit inventories should be updated at least once a year.

FIGURE 6. ORGANIZATIONAL UNIT INVENTORY

SPACE INVENTORY — PAGE 1.

CHEMISTRY

RUN DATE 10-25-67

FLO LEV	BLDG NO	BLDG NAME	ROOM NO	CARD NO	TYPE ROOM	NET AREA	** SOC SEC	OCCUPANTS NAME	ACCOUNT	PERC ON ACCT	PRIOR SPACE THIS ORG	PRIOR SPACE OTHER ORG
					** NON-ASSIGNABLE SPACE **							
B	0484	CHEMISTRY	006	A	CIRCULATION AREA, LOBBY, FOYER	38	416054908	JAMES K GLADDEN	02 12520	75.0	38	
02	0484	CHEMISTRY	2018	B	MECHANICAL ROOM	64			02 17110			32
03	0484	CHEMISTRY	358	A	MECHANICAL ROOM	124			02 17110			62
					******** OFFICES *********							
04	0463	PHYSICS	444	A	FACULTY	262	448226583	JOE S HAM	02 12520	37.5	131	
				B			448226583	JOE S HAM	02 12530	37.5		131
02	0473	SYSTEMS	223	A	GENERAL ADMINISTRATIVE	252	459549451	ANDREW D SUTTLE JR	02 12520	25.0	63	
				B			459549451	ANDREW D SUTTLE JR	02 15110	75.0		189
B	0484	CHEMISTRY	001BAA	A	SERVICE	36			02 12520		36	
B	0484	CHEMISTRY	006B	A	FACULTY	187			02 12520		187	
B	0484	CHEMISTRY	006C	A	SERVICE	18			02 12520		18	
B	0484	CHEMISTRY	006D	A	SERVICE	8			02 12520		8	
B	0484	CHEMISTRY	007	A	GRADUATE ASSISTANT	200	523367867	FRANK J SMENTOWSKI	02 12520	75.0	200	
B	0484	CHEMISTRY	014X	A	SERVICE	16			02 12520		16	
B	0484	CHEMISTRY	015	A	GRADUATE ASSISTANT	299			02 12520		299	
B	0484	CHEMISTRY	015A	A	SERVICE	6			02 12520		6	
B	0484	CHEMISTRY	016	A	SERVICE	40			02 12520		40	
B	0484	CHEMISTRY	016AB	A	SERVICE	40			02 12520		40	
B	0484	CHEMISTRY	017AA	A	SERVICE	140			02 12520		140	
B	0484	CHEMISTRY	017AB	A	SERVICE	162			02 12520		162	
B	0484	CHEMISTRY	023	A	GRADUATE ASSISTANT	147			02 12520		147	
B	0484	CHEMISTRY	025	A	FACULTY	200	378301769	EDWARD A MEYERS	02 12520	75.0	200	
B	0484	CHEMISTRY	026	A	GRADUATE ASSISTANT	310			02 12520		310	
B	0484	CHEMISTRY	027	A	FACULTY	220	452403668	RICHARD M HEDGES	02 12520	75.0	220	
B	0484	CHEMISTRY	033	A	FACULTY	175	452542261	JACK H LUNSFORD	02 12520	75.0	175	

PRORATION SYSTEM

The proper management of non-teaching space dictates the need for assigning a function or functions to each room. For example, the office of a professor who works one-half time on teaching duties and one-half time on sponsored research actually supports both of these programs. The space of this office should be prorated to show both the teaching and the research function.

If the program use of the space of an institution is to be properly reported, a proration system is necessary. The most desirable approach to this problem is to relate the use of all space to the major functions of the institution.

This can best be done by relating the function of a room to the chart-of-accounts of the institution. In the case of the previous example of the professor (who taught one-half time and worked on sponsored research one-half time) one-half of his office space would be assigned to a teaching account number and one-half to a research account number. If an account number (or numbers) is assigned to each room, then it becomes possible to develop a space budget.

In the case of offices, the proper proration to an account number can be made by prorating the space in the same manner in which the occupants salary is prorated. For other types of space, such as a research lab or work area, the proration would have to be assigned by the judgment of the administrator of the organizational unit utilizing the space.

Figure 6 illustrates a departmental unit inventory and shows the proration of the space of individual rooms to various budget accounts. Once this proration has been made for each room of each organizational unit, then a total institutional prorated space inventory is available. If, for example, one wanted to determine how much space was devoted to research at a given institution, this could be done by listing all research accounts and then accumulating all of the space assigned to these accounts in the total institutional space inventory. Figure 7 illustrates a sample listing of an institution's space by major budget designation.

FIGURE 7 · SPACE BUDGET

SUMMATION OF ASSIGNABLE SPACE
BY
MAJOR BUDGET CATEGORIES

General Administration	80,000
Instruction	1,100,000
Organized Research	380,000
Public Service	150,000
Library	90,000
Auxiliary Services	100,000
Organized Activity	60,000

Since accounts change frequently in an institution, it would be necessary to update the proration system at least once a year. Once the inventory is updated, then this inventory would be utilized as the basis for reporting until it was updated again. The proper proration of space to the various programs of teaching, research, and public service is perhaps the most difficult step of the space management system. The assistance of the person in charge of each organizational unit is vital in order to assign logical percentages of the space in each room to the programs involved.

UTILIZATION EVALUATION

Just as it is desirable to have a method of evaluating the utilization of teaching facilities, it is even more important to have a technique to evaluate the utilization of non-teaching facilities. The application of a space factor to this type space is not possible and therefore a different approach will be outlined.

The technique recommended for evaluating the utilization of non-teaching space is one of relating the space needs of an organizational unit to the program it is conducting and comparing this required space (S_r) to the space assigned (S_a). By taking a ratio of assigned space (S_a) to required space (S_r), a utilization ratio (U_r) can be determined as follows:

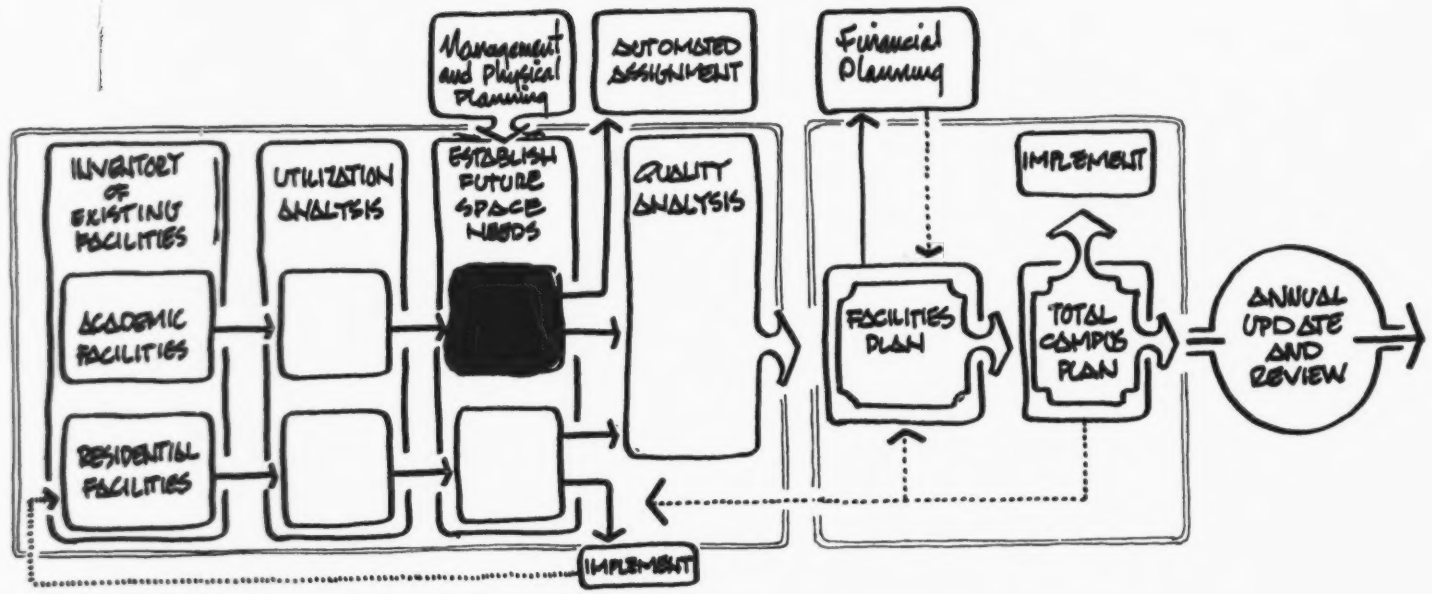
$$U_r = \frac{S_a}{S_r}$$

If (U_r) is less than or equal to one, then the space assigned is equal to or less than that required and good utilization is being obtained (no space wasted). If (U_r) is greater than 1.0, then the space assigned is greater than that required by the program being conducted and evidence of poor utilization is indicated.

The utilization ratio could also be used to determine a priority for assignment of additional space to a given organizational unit. Organizational units requesting space could be ranked according to their utilization ratio. Those with the smallest ratio would receive the highest priority for additional space.

In order to compute a utilization ratio for a given organizational unit, it is first necessary to develop values for the non-teaching space required (S_r) for the organizational unit. The non-teaching space required (S_r) for the programs of a given organizational unit can be estimated as discussed in the following section of this report on Estimation of Space Requirements. The space assigned (S_a) to a given organizational unit can be obtained from an organizational unit inventory of the type shown in Figure 6.

ESTIMATION OF SPACE REQUIREMENTS



TEACHING FACILITIES

Teaching facility space was defined in the previous section and techniques for estimating the need for this type space will be presented here. The previously discussed space factor and student contact hours provide the basic parameters for estimating space needs for teaching facilities. Figure 8 illustrates the basic process for determining the Student Contact Hours for each academic department. The use of these basic parameters will be discussed in the following sections.

STUDENT CONTACT HOURS

Student contact hours (SC_tH) represent the student-hours of room use per week. For example, a course that has 40 students and meets for 3 lecture hours and 3 lab hours per week would generate 3 x 40 or 120 SC_tH in lecture and 3 x 40 or 120 SC_tH in lab.

The number of student contact hours per week (lecture and lab) that are generated by a given academic department is dependent upon:

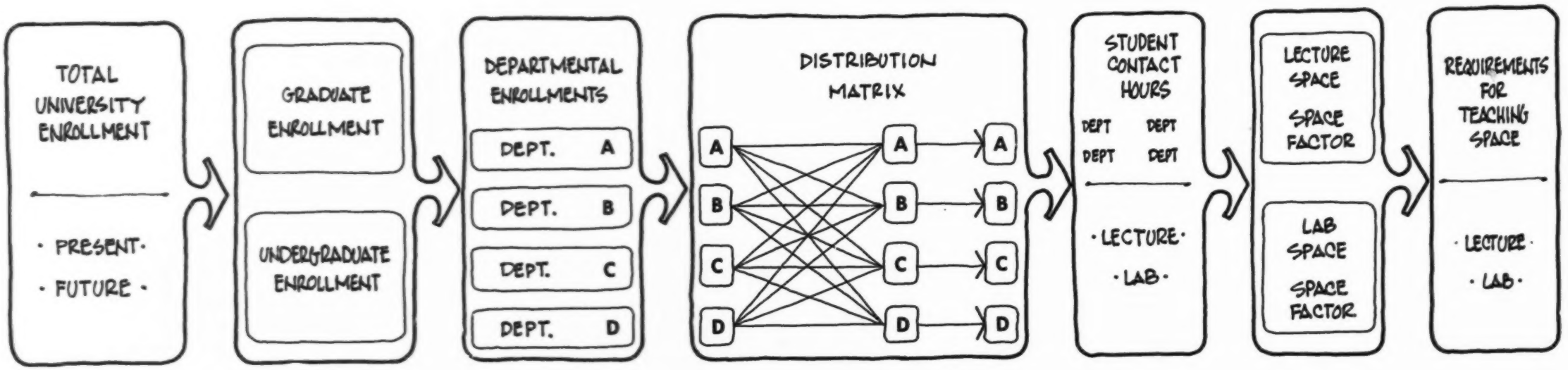
(1) The curriculum of that department,

(2) The number of students majoring in that department, and

(3) The number of students from other departments that take courses in the department.

A technique for predicting the student contact hours per week that are generated during a peak semester by a given department is presented in Volume II on Management and Program Planning and this material will not be repeated here. A basic point to remember is that the best unit for predicting student contact hours is an academic department. It will also be necessary to utilize space factors unique to specific departments due to the different teaching requirements.

FIGURE 8 · STUDENT CONTACT HOUR GENERATION



SPACE FACTOR - CLASSROOMS

A Space Factor (SF) of 1.0 was previously discussed as a reasonable par value for classrooms. This factor results from an average of 15 sq. ft. per student station, 30 hours scheduled per week, and 50 percent station utilization. It would be possible to increase the average hours scheduled per week to 40, and by good scheduling the station utilization could be increased to 60 percent. These conditions would produce a space factor of:

$$SF = \frac{15}{40 \times .6} = 0.62$$

This range from 0.62 to 1.00 represents a feasible range for classroom space factors that could be used for evaluation or estimation of space requirements. A value of 0.9 will be suggested here as a desirable value for planning purposes.

Unless some unique classroom requirements (such as special audic or visual aid equipment which might cause one to classify the room as a teaching lab) are established for a given department, then the value of 0.9 could be utilized for all departments. Smaller rooms will usually have a design element greater than 15 sq. ft. per student station but will generally enjoy a greater percent utilization. Large lecture rooms have a smaller design element but also may have a poorer station utilization.

SPACE FACTOR - LABORATORIES

The major variable with respect to developing a space factor for labs is the area per student station (A_s). This will vary by each teaching department due to different teaching methods required. For example, an architectural lab might require a design of 55 sq. ft. per student station while a biology lab might require 30 sq. ft. per student station. In this case consider that 20 hours are scheduled per week with 60 percent station utilization for both labs then the respective space factors would be as follows:

$$SF_{(Arch)} = \frac{55}{20 \times .6} = 4.58; \qquad SF_{(Biol)} = \frac{30}{20 \times .6} = 2.50$$

These factors are presented only as an example of space factors for teaching labs.

Suggested space factors that can be used as guidelines for estimating laboratory space requirements are presented for some general academic departments as follows:

	Area Per Student Station	Space Factor
Architecture	55	4.4
Art	60	4.8
Biology	35	2.8
Chemistry	45	3.6
Communication Arts	50	4.0
Foreign Languages	35	2.8
Geology	50	4.0
Home Economics	45	3.6
Music	30	2.4
Physics	45	3.6
Business Administration	40	3.2
Education	40	3.2
Engineering	60	4.8

The previous space factors are somewhat liberal with respect to the hours scheduled per week (H_w). If the student demand for courses is large enough to permit scheduling the lab 25 or more hours per week then it is desirable to utilize a lower factor. For example consider a Physics Department that can schedule its teaching labs an average of 30 hours per week with 60% utilization. The space factor in this case would be as follows:

$$SF_{(Physics)} = \frac{45}{30 \times .60} = 2.5$$

It also may be necessary to develop space factors for specific labs such as lower level labs versus upper level or graduate labs. In general it is recommended that each institution develop space factors for teaching labs on a department by department basis. This can be done by considering the following:

(1) Area required per student station for teaching the lab courses of the department.

(2) Potential hours that the labs can be scheduled per week. This will depend upon student demand and flexibility of lab use.

(3) Percent station utilization when in use.

SERVICE SPACE

There is a need to provide service space for classrooms and laboratories. This space would provide for projection rooms, cloak rooms, storage, preparation rooms, animal rooms, etc. The space factors (classroom and laboratory) recommended for estimating future teaching space are adequate to provide sufficient space for both the teaching and service with some exceptions. The exceptions would occur where departments require extremely large preparation areas, animal holding quarters, cold rooms, etc. This type of space should be considered as an additional requirement and estimated separately for each department. It could be reported under the Special Uses Category for Non-Teaching Space as developed in the following section.

TOTAL SPACE

A suggested format of a table for estimating total space requirements for teaching facilities is illustrated in Figure 9.

NON·TEACHING FACILITIES

Non-teaching facilities are defined here as those facilities providing the following types of space:

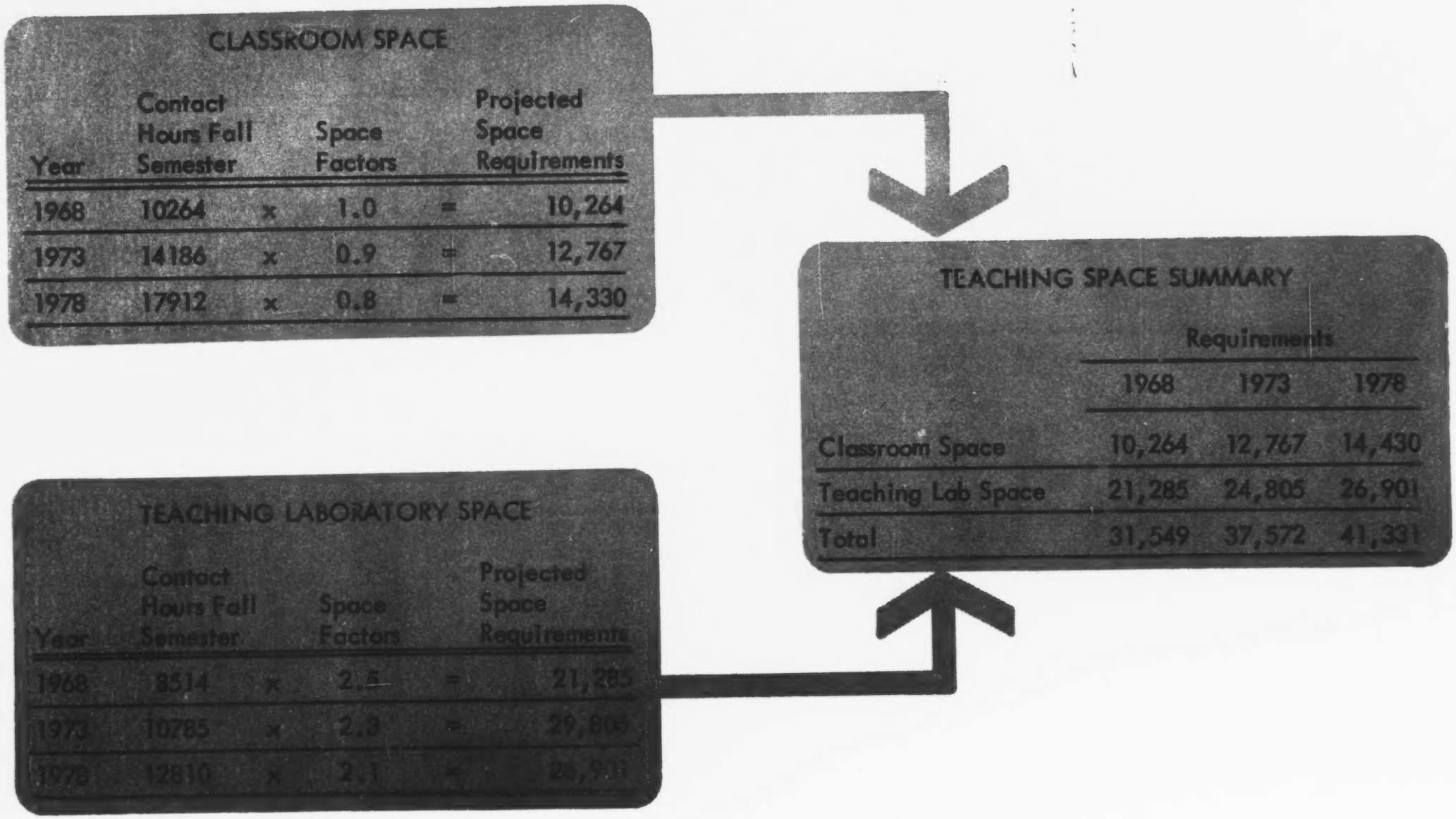
(1) Offices
(2) Support Space
(3) Conference Rooms
(4) Research Laboratories
(5) Public Service and/or Extension Facilities
(6) Storage and Service Areas
(7) Special Uses

The non-teaching space is related to that which would be utilized by an organizational unit such as an academic department, research institute, extension unit, dean's office, library, student programs, registrar, etc. The total non-teaching space requirements of the university would be reflected by a summation of the requirements for all of the organizational units.

The basic concept to be employed is that of first estimating the space needs of each individual organizational unit of an institution and then combining these needs to produce total institutional needs. This permits developing a close relationship between the program and/or level of activity of a given organizational unit and its space requirements.

The space needs of a given organizational unit would thus develop from first establishing the program of the unit (See Volume II, Management and Program Planning) and then determining the space requirements of the program. The basic parameter of non-teaching space is the number of personnel to be utilized in the program of a given organizational unit. Techniques to estimate space requirements generated by a given program will be discussed in the following sections.

FIGURE 9 · TEACHING SPACE REQUIREMENTS



PERSONNEL CATEGORIES

The basic parameter for estimating non-teaching space is the number of personnel required for the various programs of the institution. Figure 10 illustrates the basic process to be utilized in estimating non-teaching space.

In order to estimate space needs from personnel it is first necessary to establish a few basic categories for personnel definition. A suggested list of personnel categories is as follows:

(1) Professional or Supervisory - This would include instructors - professors, research scientists, administrators, and other professional or supervisory personnel for which private or semi-private offices would be provided.

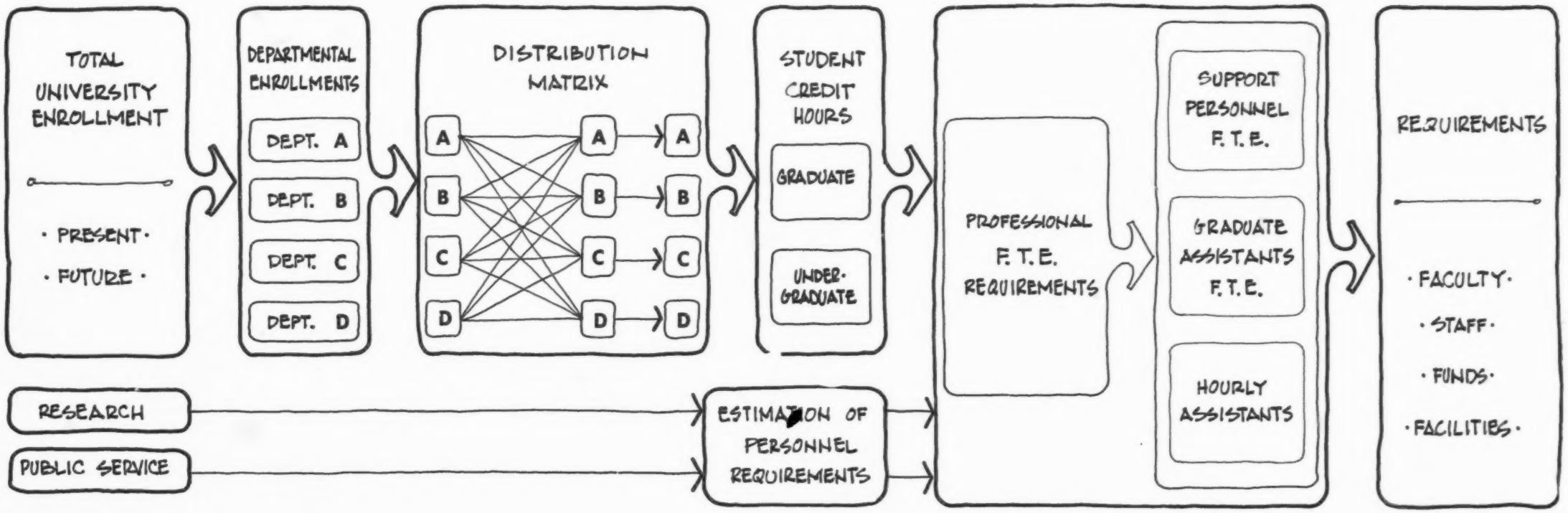
(2) Support - This would include secretaries, clerical, staff, technicians and other similar personnel for which work space must be provided.

(3) Graduate Assistants - Graduate students which are employed in teaching, research, or extension. If desired, a further breakdown of non-employed graduate students (with fellowships or other similar types of financial aid) could be utilized.

(4) Hourly - Part-time students or staff employed on an hourly basis for which work space is required.

The personnel of a given organizational unit would be distributed to one of the above four categories. Each person would be reported in terms of a full-time equivalent (F.T.E.) which is defined as a person working full time for 12 months a year. The number of full time equivalents in each category would be determined for a given organizational unit and this number utilized to estimate space needs as indicated below. These F.T.E. values are developed as a basic part of the management and program planning phase discussed in Volume II.

FIGURE 10 · NON-TEACHING SPACE ESTIMATION PROCESS



ESTIMATION OF NON-TEACHING SPACE REQUIREMENTS

Non-teaching space requirements can be estimated by considering each of the following types of space and by assigning amounts of space to an organizational unit based on the following procedures:

(1) Office Space

The following are suggested guidelines for estimating office space needs:

Professional Category - One hundred and forty (140) square feet of assignable space per F.T.E. requiring space.

Graduate Assistant - One hundred and twenty (120) square feet of assignable space per F.T.E. requiring space.

(2) Support Space

This space provides work area for the support staff. Suggested guidelines for estimating this space are as follows:

Support Category - One hundred and twenty (120) square feet of assignable area per F.T.E. requiring space.

Hourly Category - Fifty (50) square feet of assignable area per F.T.E. requiring space.

(3) Conference Space

This provides space for conference rooms plus additional space that would provide larger offices for administrators of the organizational unit. A suggested guideline is as follows:

Conference Space - Minimum of two hundred and forty (240) square feet of assignable space for any single organizational unit or twenty (20) square feet of assignable space per Professional F.T.E.

(4) Research Laboratories

The need for research laboratory space will vary by subject fields. For example, a research scientist in Physics will require more lab space than a researcher in English. Research lab space will be estimated on the basis of the number of F.T.E.'s in the Professional and Graduate Assistant categories who are working on research. Also additional research space would have been generated by the F.T.E.'s in the Support and Hourly categories that are working in research. Suggested guidelines are as follows:

Subject Field	Square Feet Per Professional F.T.E. In Research	Square Feet Per Graduate Assistant F.T.E. In Research
Biological Sciences	250	120
Agriculture Sciences	200	100
Health Sciences	250	120
General Life Sciences	200	100
Mathematical Sciences	50	40
Computer Sciences	100	80
Physical Sciences	200	100
Engineering Sciences	250	120
Psychology	100	80
Social Sciences	100	80
General Behavioral Sciences	100	80
Fine Arts	50	40
Letters	50	40
General Humanities	50	40
Administrative Professions	100	80
Education	100	80
Environmental Design	200	100
Home Economics	200	100
Law	50	40
Social Work	100	80
General Professions	100	80

(5) Public Service Facilities

This includes public service, extension and other similar activities and the space provided here would allow special work or development space for the Professional F.T.E. A recommended guideline is as follows:

Professional Category - Eighty (80) square feet of assignable space per F.T.E.

(6) Special Uses

There will be some unique requirements for organizational units that cannot be adequately estimated by the previously discussed procedures. The special use item provides for estimating additional space for such requirements. This should be done on a basis deemed suitable to the organizational unit in question.

(7) Storage and Service

In addition to the above space, provision must be made for storage, reproduction work, and other office service needs of an organizational unit. A suggested guideline here is as follows:

Storage and Service - Five percent (5%) of total assignable space previously estimated for the organizational unit.

The estimation of non-teaching space requirements would be accomplished for each organizational unit using the guidelines suggested above and data on F.T.E. values from the planning report of the organizational unit (see Volume II for discussion of planning report).

EXAMPLE

An example of a work sheet for estimating the non-teaching space needs of an organizational unit is shown in Figure 11 on Page 53. The estimates shown are based on the following F.T.E. figures for the example organizational unit (subject field - General Life Sciences):

Professional F.T.E.'s

Teaching - 12.5

Research - 4.6

Public Service - 2.1

Support F.T.E.'s

Teaching - 6.1

Research - 2.0

Public Service - 2.0

Graduate Assistant F.T.E.'s

Teaching - 4.0

Research - 2.0

Public Service - 0.0

Hourly F.T.E.'s

Teaching - 1.5

Research - 1.2

Public Service - 1.0

The summary sheet shown in Figure 11 is designed to be completed from data developed in the organizational planning report (See Volume II, Management and Program Planning). The three basic elements of the space estimate are:

(1) Number of F.T.E.'s by category
(2) Space Standard, and
(3) F.T.E. Adjustment Factor

As an example, consider the estimate of office space required for teaching. The value of 12.5 indicates the number of F.T.E.'s, the number of 140 indicates the space standard for professional offices, and the value of 1.11 is an adjustment factor for the F.T.E. value. In this case the F.T.E. value contains a number of 9 month faculty members for which office space must be provided on a 12 month basis and the F.T.E. value is therefore adjusted upward. In some cases the F.T.E. value might need to be reduced to account for F.T.E.'s for which no office or work space is required (field technicians in agriculture as an example). This procedure permits the direct utilization of the organizational planning reports discussed in Volume II to provide F.T.E. values.

FIGURE 11 · NON-TEACHING FACILITIES SUMMARY

CATEGORY	ITEM F.T.E.	× SPACE STANDARD	× F.T.E. ADJUSTMENT	= ITEM SPACE	SUB-TOTAL SPACE
1 OFFICE SPACE					
TEACHING					
PROFESSIONAL	12.5	140	1.11	1942.0	
GRADUATE	4.0	120	1.0	480.0	
RESEARCH					
PROFESSIONAL	4.6	140	1.11	613.0	
GRADUATE	2.0	120	1.0	240.0	
PUBLIC SERVICE					
PROFESSIONAL	2.1	140	1.0	294.0	
GRADUATE	0	120	1.0	120.0	
CATEGORY TOTAL					3689.0
2 SUPPORT SPACE					
TEACHING					
SUPPORT	6.1	120	1.0	732.0	
HOURLY	1.5	50	1.0	75.0	
RESEARCH					
SUPPORT	2.0	120	1.0	240.0	
HOURLY	1.2	50	1.0	60.0	
PUBLIC SERVICE					
SUPPORT	2.0	120	1.0	240.0	
HOURLY	1.0	50	1.0	50.0	
CATEGORY TOTAL					1397.0
3 CONFERENCE (MINIMUM: 240 S.F.)					
PROFESSIONAL	19.2	20	1.0	384	
CATEGORY TOTAL					384.0

CATEGORY	ITEM F.T.E.	× SPACE STANDARD	× F.T.E. ADJUSTMENT	= ITEM SPACE	SUB-TOTAL SPACE
4 RESEARCH LABS					
PROFESSIONAL	4.6	200	1.0	920.0	
GRADUATE	2.0	100	1.0	200.0	
CATEGORY TOTAL					1120.0
5 PUBLIC SERVICE FACILITIES					
PROFESSIONAL PUBLIC SERVICE	2.1	80	1.0	168.0	
CATEGORY TOTAL					168.0
6 SPECIAL USES *					1450.0
TOTAL CATEGORIES 1-6					8208.0
7 STORAGE AND SERVICE					
TOTAL OF 1-6	8208 × .05				
CATEGORY TOTAL					410.0
TOTAL CATEGORIES 1-7					8618.0

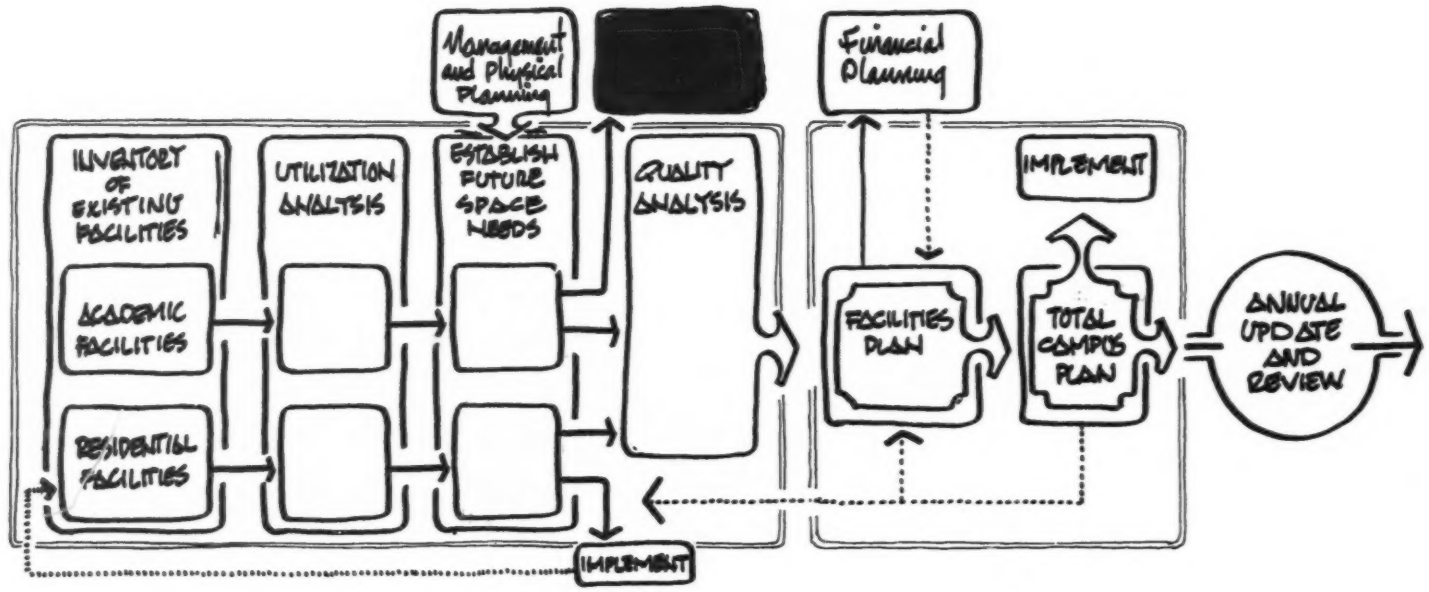
* ATTACH SEPARATE SHEETS FOR JUSTIFICATION OF THESE REQUIREMENTS

EXAMPLE:

SPECIAL REFRIGERATION ROOM 450.0
PREPARATION ROOMS 1000.0
TOTAL 1450.0

NOTE: ALL SPACE TOTALS ARE IN SQUARE FEET.

AUTOMATED ASSIGNMENT OF TEACHING FACILITIES



2

The basic control over the utilization of teaching facilities (classroom, labs) resides in the process of scheduling these facilities for use. Two separate steps are required in this process which are:

(1) Master Schedule Construction
(2) Student Sectioning

The master schedule construction consists of examining faculty resources, room resources, and curriculum requirements and assigning a room, time, and faculty member to each section of every course that is to be offered by the university. It can be seen that an almost infinite number of choices results in making this total assignment. However, the efficient and effective utilization of both faculty and facilities, as well as the ability to furnish the students with a workable schedule of desired courses is dependent upon this assignment.

Student sectioning is the process of considering the master schedule of classes and student requests for courses and preparing a class schedule for every student. The basic problem here is to maximize the probability that each student can obtain requested courses while obtaining effective utilization of faculty and facilities.

The magnitude of the task of completing a master schedule and of student sectioning is, of course, significantly influenced by the size of the institution, the number of courses and the curriculum flexibility. The utilization of computers in completing these two steps is a logical move and therefore automated scheduling will be briefly outlined here with particular emphasis on the benefits that can be obtained for teaching-facility utilization and overall institutional planning.

MASTER SCHEDULE CONSTRUCTION

The basic data required to prepare a master schedule of classes is discussed as follows:

Faculty Resources - Each course must be considered and the faculty members which are qualified and available to teach must be listed for each course. Also teaching load, time restrictions, and preferred course assignments must be provided for each faculty member.

Teaching Facilities - Each room (classroom or lab) available for teaching must be listed along with its characteristics (student stations, special equipment, etc.). These data should be available from the space inventory previously discussed.

Course Requests - An estimated student demand for each course must be developed.

Course Requirements - For each course it is necessary to list special time configurations, required class size, and special room requirements. Two basic goals should be kept in mind regarding master schedule construction. These are:

(1) Development of a class schedule which will maximize the ability of the student body to obtain curricular requirements, and

(2) Efficient utilization of faculty and facilities.

A central university scheduling office would facilitate the realization of these goals. The function of such an office would be to coordinate the gathering and processing of basic data from each department. The departments can submit the data and indicate class size, time patterns, and facilities required but in some cases it will be necessary to void these constraints if the overall goals are to be attained.

The attainment of the first goal on faculty and facility utilization demands that the courses be spread out over the day and week and over the total facilities available for use. General classrooms must be available for total institutional use rather than being "owned" by specific departments if good utilization of this space is to be achieved. By having a large number of potential classrooms to choose from, it is possible to obtain a better match of class and classroom size.

The total optimization of the master schedule construction is an extremely difficult task even when utilizing computers. It is a massive dynamic programming problem and there is great difficulty in choosing the proper optimization criterion. Purdue University has developed a program called Comprehensive University Scheduling System (CUSS) which utilized a step-by-step optimization. This procedure does not produce a global optimization but provides a high degree of optimization and represents an extremely valuable development in this area.

STUDENT SECTIONING

A student-sectioning program utilizes the course requests of the student body and a master schedule of classes and produces individual class schedules for each student. The goals of such a program are as follows:

(1) To maximize the probability that a student can schedule the courses which he has requested.

(2) To assure that the students are distributed uniformly over the sections that are available.

(3) To assure that maximum class sizes are observed so that class size will not exceed room size or desired teaching limits for any class.

(4) To provide desired reporting on section sizes, room utilization, and other pertinent management information.

(5) To provide a simulated registration well in advance of the start of classes so that any problems (such as conflicts in hours and insufficient number of sections) may be corrected.

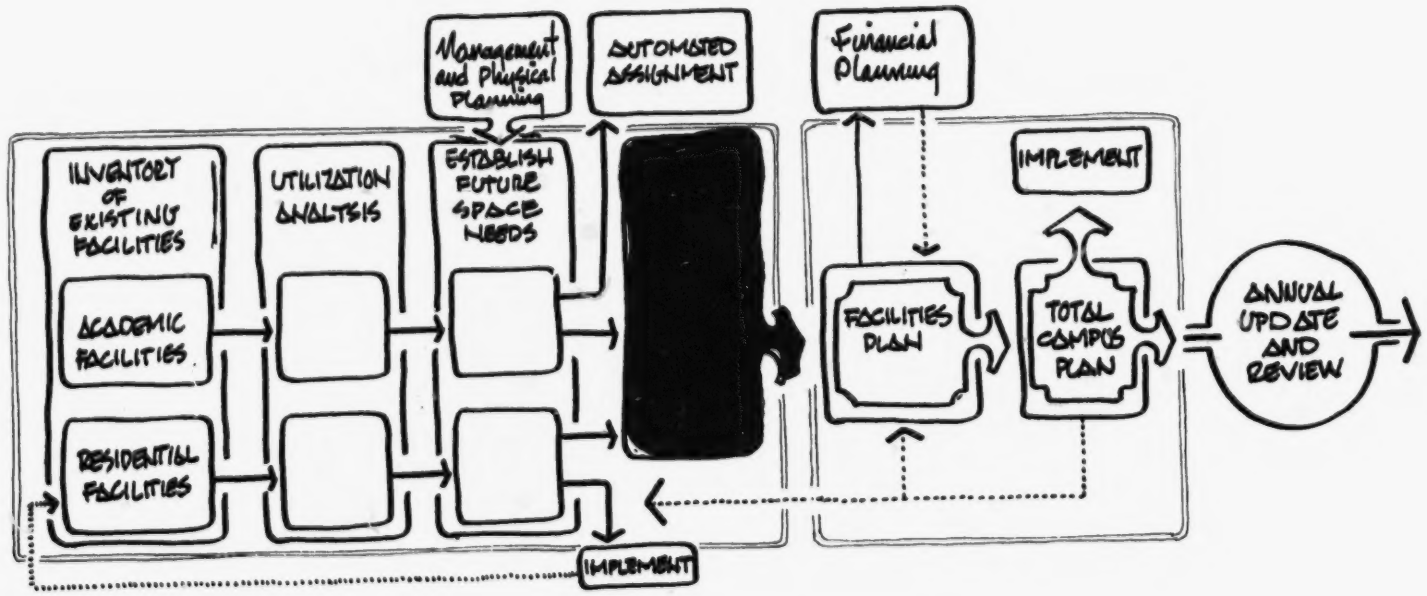
The master schedule provides the blueprint for maximizing the ability of the student to obtain required courses and for obtaining good utilization of facilities and faculty. The student-sectioning program is the means for implementing this blueprint. It provides the overall control to the scheduling process that is required.

SUMMARY

The aspects of an automated system of Master Schedule Construction and Student Sectioning has been briefly presented. The main emphasis intended here is to illustrate the importance of such techniques to the overall job of space management and utilization and to indicate their importance to the overall planning process.

There is little doubt that such automated systems will become basic elements of future university operation and administration. They provide great benefits to the overall process of maximum effective utilization of available resources.

QUALITY ANALYSIS OF EXISTING FACILITIES



PURPOSE

In addition to considering the utilization of existing space, it is equally necessary to consider the quality or condition of those existing spaces.

Traditionally, classification of existing buildings has involved individual evaluations which vary in extent and quality, depending on the individual conducting the evaluation. Therefore, there is a definite need for a systematic analysis which would cover all aspects of the problem (extent) and offer a logical means for making the desired analysis and subsequent decisions (quality). The evaluation system presented here was conceived with such considerations in mind and was designed for use by qualified personnel as an aid in the decision-making process. The ultimate goal of this system is to classify all existing buildings in one of the four following categories:

(1) Satisfactory - No modifications required during the planning period.

(2) Satisfactory - Minor modifications required.

(3) Unsatisfactory - Major alterations and modifications required.

(4) Unsatisfactory - Should be demolished.

BASIC CONSIDERATIONS

Traditionally, evaluations of existing buildings have considered only the physical aspects. However, "quality" analysis implies attention to all relevant factors including physical considerations. Therefore, the basic approach of the system recommended includes three analytical phases which contribute information upon which to base a quality classification decision. Those phases are listed as follows:

Physical Analysis will result in a numerical rating of the condition of the building. (After all analyses have been completed and a decision made on the building, this information can be an input into financial planning and physical plant planning.)

Intangible Analyses will bring forth factors whose "weight" will vary from case to case, but which are necessary for a complete, thorough analysis of alternatives.

Cost Analysis serves to better define the implications of choosing various alternative categories for a building.

It is conceiveable that the initial physical rating will place a building in a certain category and that this rating will move towards the highest "adequate" rating or towards the lowest "demolish" rating as the building is evaluated through intangible and cost analyses.

PHYSICAL ANALYSIS

This analysis permits a basic evaluation of the physical condition of a building. It includes consideration of the following items:

I. Primary Structure
   1. Foundation
   2. Wall System
   3. Floor System
   4. Roof System

II. Secondary Structure
   1. Ceiling System
   2. Interior Walls and Partitions
   3. Window System
   4. Door System

III. Service Systems
   1. Cooling System
   2. Heating System
   3. Plumbing System
   4. Electrical System

IV. Functional Standards
   1. Assignable Space
   2. Adaptability
   3. Suitability

V. Safety Standards

Most of the above items are self-explanatory, but a few need further comment. Functional Standards relate to the consideration of how usable a space is relative to its physical characteristics versus its actual use. In this category, assignable space refers to those areas in a building which can actually be assigned to a functional use; adaptability is synonomous with flexibility; and suitability considerations take into account the need to evaluate the actual working and/or learning environment of the spaces of a building.

Through use of a rating system relative to the above items, each individual building is placed in a category of satisfactory (adequate, remodel) or unsatisfactory (alter, demolish).

INTANGIBLE ANALYSES

This analysis permits the consideration of intangible, though relevant, factors such as aesthetics and traditional and/or historical images. The intangible analysis includes both negative and positive considerations.

Negative Analysis - This analysis might indicate that although the building is evaluated as "adequate", the negative aspects of its appearance or some other consideration might warrant its being "remodeled, altered, or demolished." Such negative considerations would include, but not be limited to, the following:

(1) Intangible Problems: physical orientation of building; psychological environment; noise; odors; etc.

(2) Aesthetics: exterior and/or interior visual appearance; visual and/or physical arrangement with other buildings; etc.

(3) Future Land Use Configurations:
conflicts of use, function, circulation, service; location and expansion relative to similar discipline and/or functional types; etc.

(4) Building Suitability and Environs:
spatial characteristics relative to specific use(s) or such spaces.

(5) Social and Community Aspects:
conflicts and attitudes detrimental to campus and community intra- and inter-relations.

Positive Analysis - This analysis covers those considerations which might influence a previous decision to "demolish" to be changed to an "alter" decision. This change could result from the evaluation of the following positive considerations (others would exist with the individual institutions):

(1) Traditional Value: significant roll or meaning relative to a group's or institution's customs, habits, or traditional practices.

(2) Historical Value: significant role or meaning relative to an historical event.

(3) Aesthetics: exterior and/or interior visual appearance; visual and/or physical arrangement with other buildings; etc.

(4) Social and Community Aspects:
values and use for social activities of the institution and/or the community; role in overall campus environment; etc.

(5) Intangible Assets: facility could be used temporarily for other functions or activities; highly specialized usage of space that is difficult to replace; etc.

COST ANALYSIS

If a building has an "alter", "remodel" or "demolish" rating (via physical and intangible evaluation) then cost analysis would determine the relative economics of the decisions possible. Cost analysis would include (but not limited to) the consideration of:

(1) Cost Data
(2) Replacement Costs
(3) Improvement Items
(4) Cost Estimates
(5) Cost Studies

QUALITY ANALYSIS PROCESS

The flow diagram in Figure 12 illustrates the basic process of the quality analysis. The physical considerations (Phase I) are obviously the most significant but the successive phases of intangible and cost analyses provide necessary additional information so that a final decision will result from due regard of all relevant factors.

RATING SYSTEM

It is desirable to have a rating system which can be used in conjunction with the quality analysis phases that were presented in the previous section. In the instances explained below, a numerical rating system can be used to aid a quantitative decision relative to the evaluation of any existing building.

PHYSICAL ANALYSIS

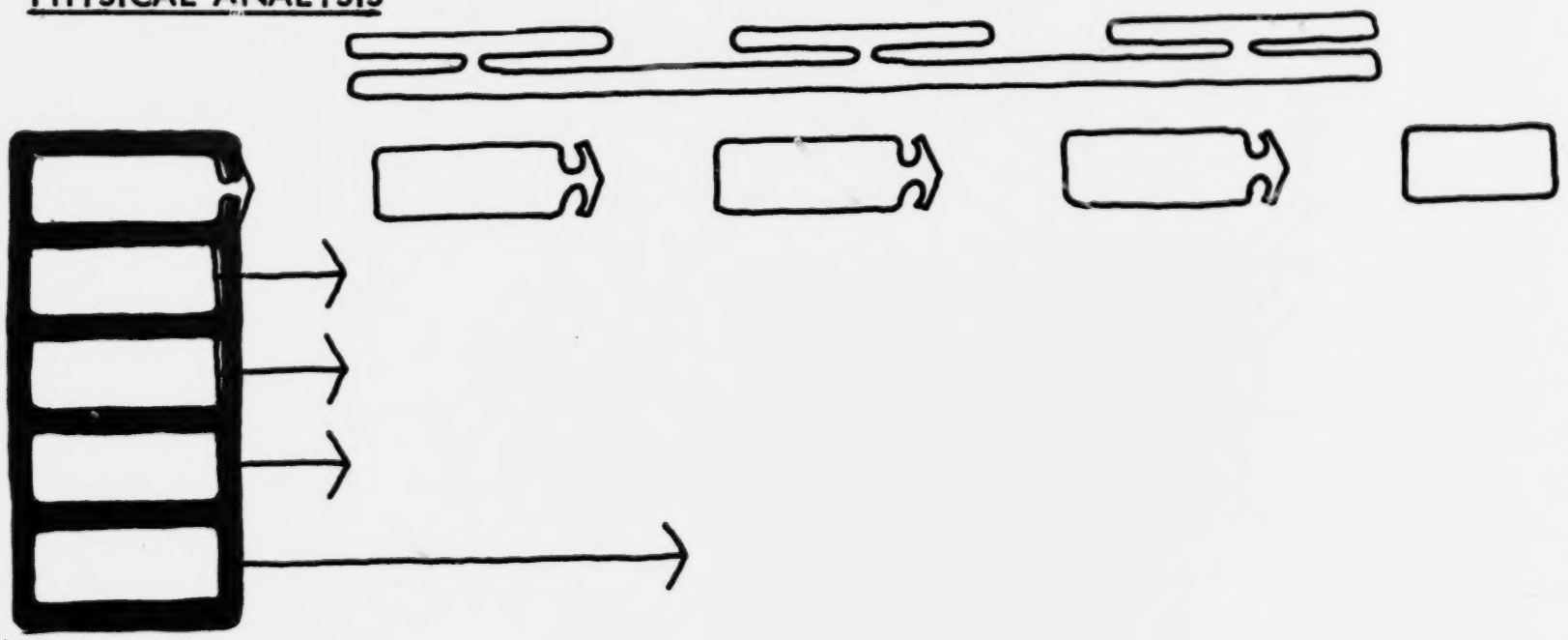
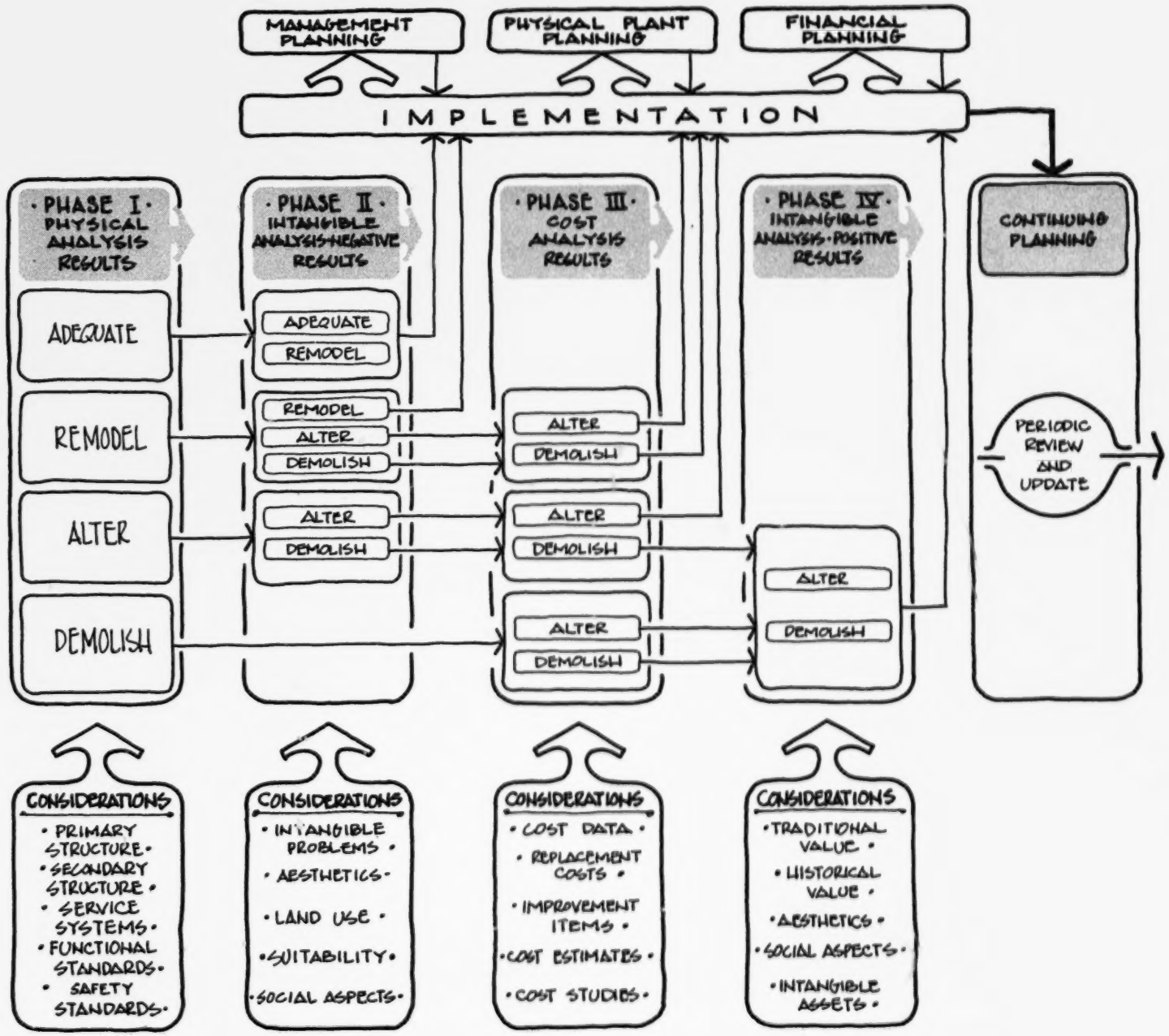


FIGURE 12 · QUALITY ANALYSIS PROCESS



The values of each of the following categories and their individual components are based upon the role they play in relation to the total well-being or life expectancy of the structure. Value in this instance refers not only to the cost of the components involved, but also to the ease or difficulty of repair, alteration, or replacement of specific structural elements, as well as the characteristics relative to expected or alternate uses.

The physical rating system is composed of five major categories which are based upon a point scale ranging from 0-100. These five major categories and their point distribution are:

Primary Structure	44
Secondary Structure	12
Service Systems	24
Functional Standards	12
Safety Standards	8
	100

Each category is further divided into components and each component is assigned a fixed value. Therefore, a fixed value is employed to enable the significant components to carry the appropriate values in relation to the total building quality. For example, the primary structure is the most significant consideration and has a fixed value of 44 points of the total 100. There are 4 components in this category which are assigned a fixed value based upon the total 44 points. They are:

Foundation	14
Wall System	14
Floor System	8
Roof System	8
	44

The ultimate rated value is based upon a condition value that is utilized to measure the quality of the fixed factors. The condition value is based upon a constant scale of 0-10 points and the assignment of this value is based upon the ease or difficulty in correcting the component factor. In order to establish the condition value of a structure, there are four questions that must be considered. Particular points are then assigned depending upon how the questions are answered. The questions and the respective points are as follows:

1 Are corrective measures needed?
No (-0) _____
Yes (-1) _____
2 Correction is easy (repair) (-2) _____
3 Correction is difficult (alter) (-5) _____
4 Correction is impossible (replace) (-9) _____

Therefore, if the answer to the first question is "no" then the condition value receives the full ten points. If the answer is "yes" then a point is reduced and then, depending upon the corrective measures required, additional points are reduced.

The assigned variable condition value is then multiplied times the fixed value (and divided by 10) in order to determine the component's ultimate value. The rating formula and an example is as follows:

. Example: 1. Primary Structure
A. Foundation (Fixed Value = 14)
-1_____Yes - Corrective measures are needed
-2_____Correction is easy
. Maximum Value of 10 points minus 3 corrective points = 7 (Condition Value).
. $\frac{\text{Fixed Value X Component Condition Value}}{10} = \frac{14 \times 7}{10} = 9.8$ Foundation Rating

Each rating system section is completed in the same general manner until the five major categories and their components have been rated. The total points will indicate a particular rating category into which the structure is placed. The rating categories are:

Satisfactory	Adequate	95-100
	Remodel	75-94
Unsatisfactory	Alter	40-74
	Demolish	0-39

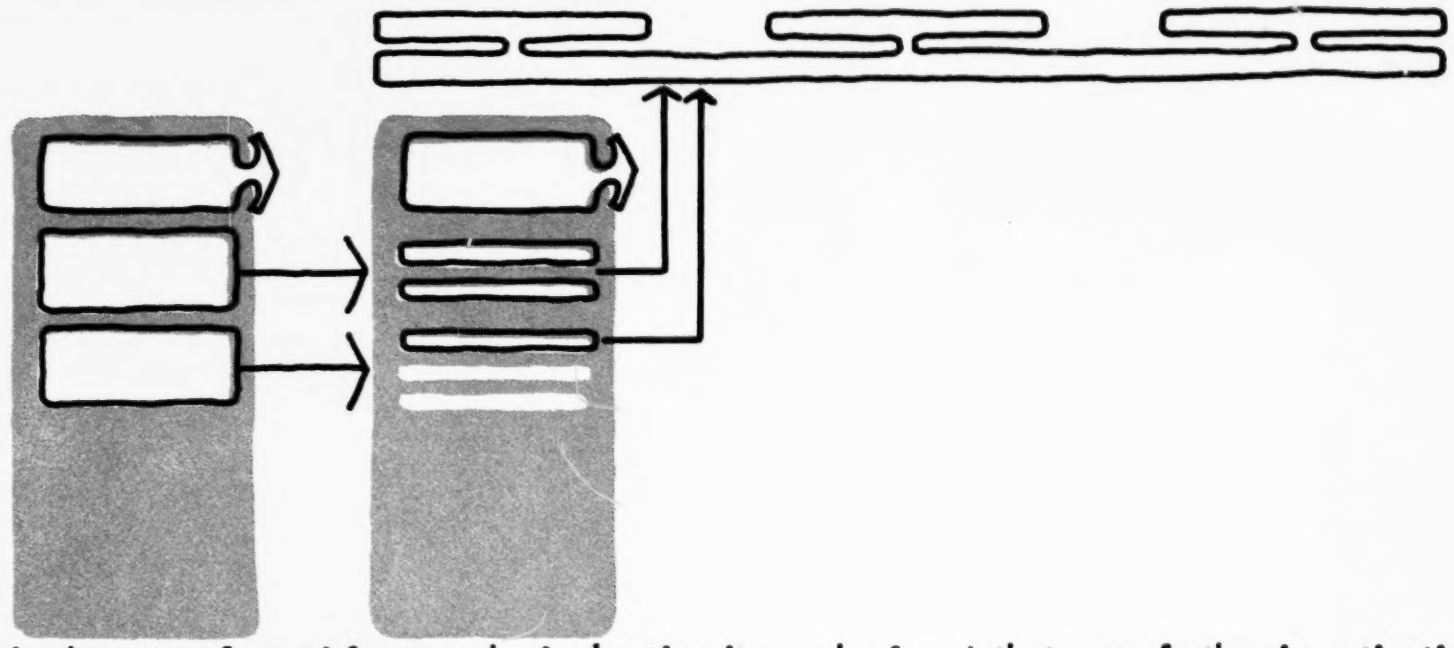
It is essential to emphasize that these ratings illustrated are suggested only as guidelines. A rigid interpretation is not encouraged, especially in the transitional areas of 40, 75, 95. Rather than a strict "black and white" interpretation the intention is directed toward a range of "grays". Typical forms for such activities as mentioned in this section are suggested in the appendix of this report.

COST AND INTANGIBLE ANALYSIS

At this point, the physical quality of a building has been rated and the building has been placed in one of four major reference categories: adequate, remodel, alter, demolish.

The following explanation now distinguishes between the satisfactory (adequate, remodel) and unsatisfactory (alter, demolish) physical ratings.

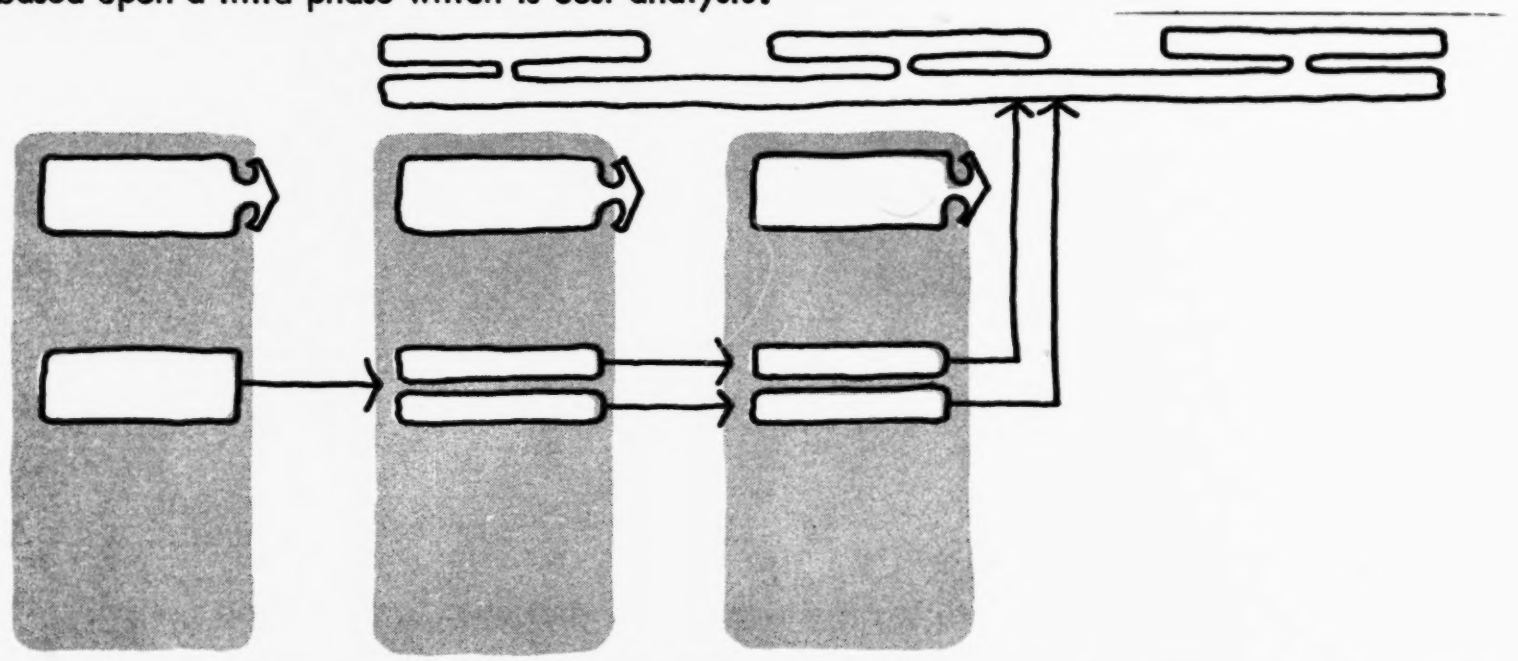
SATISFACTORY PHYSICAL RATINGS



In the case of a satisfactory physical rating it may be found that upon further investigation there are certain intangible considerations that may or may not uphold the high physical rating. For example, a structure that rates adequate in physical qualities may still be considered undesirable from a standpoint of aesthetics, emotional responses or campus image. Therefore, the building may be placed in a remodel or alter category.

This phase (II · Intangible Analysis · Negative) is designed to be responsive to such considerations and is applicable to only those situations where there is a satisfactory rating in the previous physical analysis. Due to such scrutiny, the quality of a satisfactory structure may be either reinforced or contradicted when subjected to an intangible analysis (which is designed as a negative check). If there are no serious negative factors involved and the structure retained a satisfactory rating through this Phase II analysis, then the program for that structure may be implemented. This program would specify either "no modifications required" (adequate) or "minor modifications required" (remodel).

In situations where a satisfactory physical structure is rated unsatisfactory from an intangible standpoint then the final decision as to the implementation program for that structure would be based upon a third phase which is cost analysis.

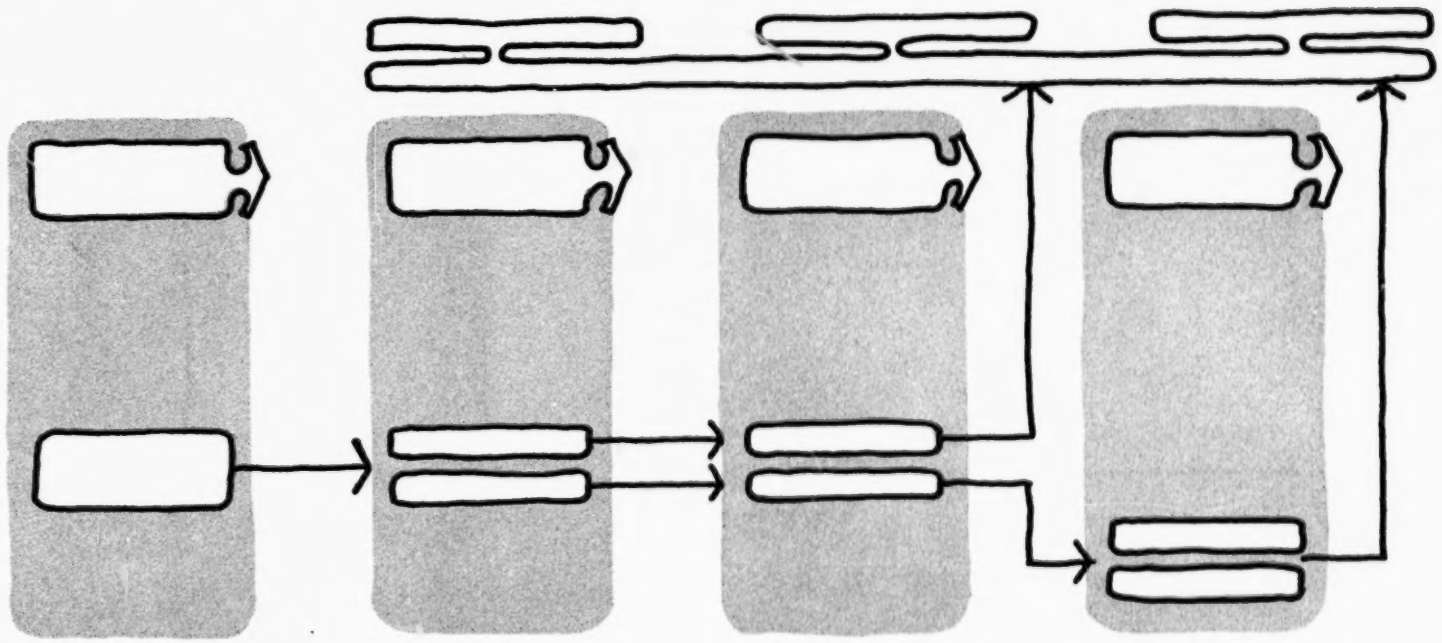


If a structure was previously satisfactory from a physical standpoint but is considered unsatisfactory from an intangible standpoint, then the intangible rating stands. The cost analysis will now provide the decision as to whether that unsatisfactory structure will be subjected to major alterations or be demolished. The cost rating is not a numerical rating as was Phase I, but merely a quantity survey and cost estimate of required improvements which are to be compared to the replacement costs of the particular structure. If the building improvement cost is less than 50% of the total building replacement cost, the structure should receive a final classification recommendation in the alter category. If the improvement cost is more than 50% of the total building replacement cost, then the structure would be classified to be demolished. Again it must be emphasized that the recommended percentage of 50% is not to be construed as an absolute but as a guide in the decision-making process. Obviously there will be borderline situations and the decision must be dealt with by the appropriate university officials who are in receipt of the analyses and responsible for final decisions.

The above discussion has traced the various alternatives that may arise from a structure that has received one of the initial physical ratings in the satisfactory category. The following discussion will deal with those situations that may arise from a structure that has received one of the initial physical ratings in the unsatisfactory category.

UNSATISFACTORY PHYSICAL RATING

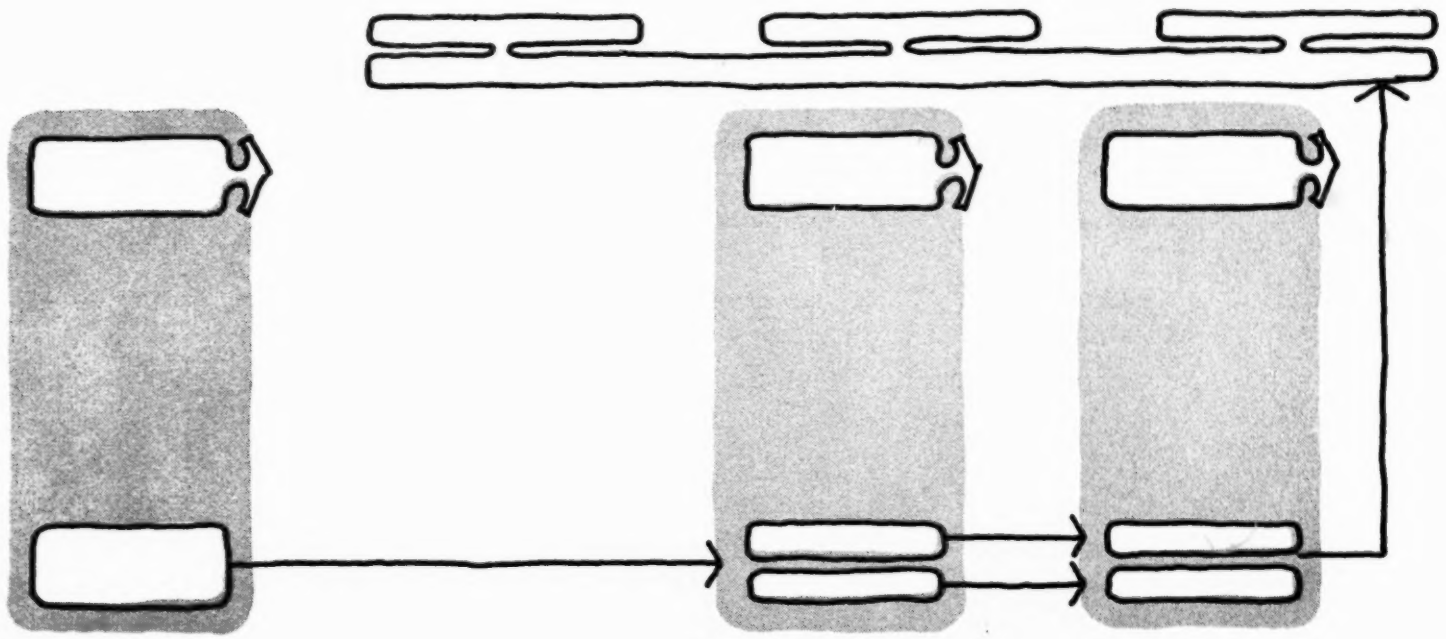
The order of the flow of the unsatisfactory rating differs somewhat from the previous discussion. If a facility is physically evaluated as "alter" in Phase I, then it is tested and scrutinized against the negative intangible considerations (Phase II) previously noted.



An "alter" rating in Phase II will be then subjected to cost alternative studies, resulting in either an "alter" or "demolish" rating in Phase III. The "alter" rating acquired in Phases I, II, and III would end in subsequent implementation. The Phase II "demolish" rating is further scrutinized in Phase IV to see if there are positive intangible considerations which would justify preserving the facility and put it in an implementation program of major modifications and alterations.

In the case of a Phase I "demolish" physical rating cost analysis is considered first and then intangible analysis. This procedure insures that all the alternatives are considered. Cost analysis will reflect the economic soundness of demolish rating, while a positive intangible evaluation may change a similar rating to "alter".

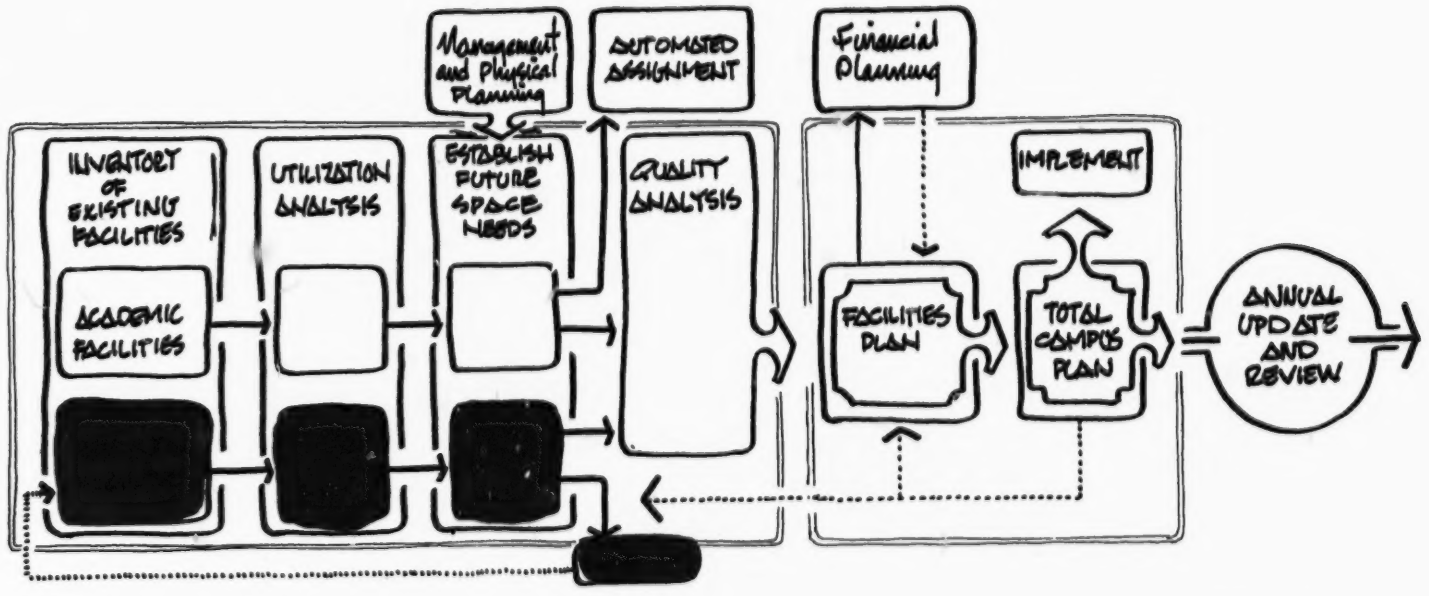
Again the same criteria will be applied as previously stated for the cost analysis - whether or not the improvement costs are more or less than 50% of the replacement cost.



SUMMARY

As an integral part of the Facilities Planning Process, the Facilities Quality Analysis Process would result in the periodic, as well as continuing review of results and data gathered at the outset. Since the decisions reached on quality are based on dynamic considerations, a review and up-date procedure is one of the necessary activities to achieve effective management and utilization of existing facilities.

RESIDENTIAL HOUSING STUDY



Residential housing for universities can frequently be isolated as a critical determinant in the growth of institutions. If housing facilities are of sufficient quantity and quality, a major constraint on the development and growth of the institution in accordance with its goals has been removed.

Thus, it is extremely important that the total facilities planning process consider the needs for residential housing in addition to developing plans for academic facilities. Although a portion of the burden of providing for the residential housing needs of a university may be allocated to the surrounding community and private enterprise, this cannot be accomplished effectively unless the university has developed factual data on its needs and a strong plan of action.

The purpose of this section of the facilities volume is to discuss basic considerations involved in a study of residential housing requirements and to suggest guidelines for developing an effective plan for residential housing.

DATA REQUIREMENTS

Educational institutions must respond to the need for residential housing. Even if the university has no intention of providing facilities, it must still address itself to those responsibilities that it is casting upon the local community. Harold Riker, in "College Students Live Here", poses particularly relevant questions that must be answered and it seems appropriate to review the following questions as an introduction to the data requirements of a housing study.[2]

[2] Harold C. Riker and Frank G. Lopez, *College Students Live Here*, Educational Facilities Laboratories, Inc., New York, N.Y., 1966, pp.99-101.

WHO IS TO BE HOUSED?

- What percent of the student body and its relative counterparts such as the graduate and undergraduate bodies are to be housed?
- Does the university provide or intend to provide any facilities for the faculty and if so what percent will be maintained?
- Are there a substantial number of married students on campus and do they represent a demand for housing?
- What percent of all housing facilities will be provided on campus?
- What controls will the university maintain on off-campus housing?
- What level of cooperation will be sought by the university with regard to the local community?
- What is the present and future availability of off-campus housing?

HOW ARE HOUSING CONSTRUCTION AND OPERATION TO BE FINANCED?

- Will such finances exert an undue burden on the college economy, and if so what means can be employed to resolve the burden and still meet the demand?
- Are the rental levels, for both on-campus and off-campus facilities at reasonable amounts?

HOW IS HOUSING RELATED TO THE OVERALL AIMS OF THE INSTITUTION?

- Will the housing establish or maintain the general academic and social tone of the total institution?

WHAT ARE THE GENERAL DIRECTIVES FOR THE PHYSICAL MASTER PLAN?

- How will the housing facilities be located in relation to the academic areas?
- How is future housing to be accommodated?
- Will the future needs necessitate the reservation of available land or the purchase of land?

WHAT LEVEL OF QUALITY IS TO BE MAINTAINED IN THE BUILDINGS?

- Are the buildings to be useful for purposes other than housing and would these uses be compatible?
- Are adequate spatial and environmental accommodations to be provided?
- Will the accommodations reflect the needs of the various user groups?

A successful and realistic residential housing study will seek answers to the above questions and express these answers in the form of a specific plan of action.

BASIC CONSIDERATIONS

Residential housing facilities are provided most frequently for student use. It is generally grossly inaccurate to simply assume that housing facilities should be provided for a certain proportion of the student body. It is necessary to thoroughly analyze the student body and break it down to the particular components that demand different housing facilities. Attention to the relevant breakdowns insures an appropriate response to the varying needs. An example of such detail would include the following information by category of student:

UNDERGRADUATE STUDENTS:
- Married (w/wo children)
- Single
- Male
- Female
- Lower classmen
- Upper classmen

GRADUATE STUDENTS:
- Married (w/wo children)
- Single
- Male
- Female

Although student housing requirements constitute the major residential housing problem for most universities, this is not the only housing question to which a university should address itself. Faculty and staff needs also require attention. The degree of attention again should be generated from a thorough analysis of needs (both qualitative and quantitative). Frequently, community facilities are not adequate to supply the diversity of types and costs that a faculty-staff body requires. Therefore, if there are obvious deficiencies or if it is conceivable that there will be, then the university must respond to this problem. This response could assume many forms ranging from the encouragement of an accelerated community facilities program to the direct construction of facilities for faculty and staff by the university.

The consideration for whom housing is to be provided is undoubtedly the most significant factor involved. However, there are other extremely relevant considerations that require equal attention and emphasis. A synopsis of these considerations are discussed in the following sections.

UNIVERSITY-COMMUNITY COOPERATION

Any time an institution has determined that additional housing units will be necessary (present or future), it is extremely important to have a clear policy statement as to what dependence the university is placing upon the community to provide the required housing. Without such an understanding it is possible and highly probable that all incentive on the part of the private sector will be eliminated. As a result, the institution may have to shoulder the burden of providing all additional housing required. It is essential, therefore, to achieve a careful balance between the university building program and the private community contribution in order to enhance and continue a desired program for providing residential housing facilities.

UNIVERSITY POLICY

Policy is a key factor. It is also, unfortunately, an area of concern that is often disregarded or de-emphasized as policy implies commitment. The prevalent attitude toward such directives is that they should stand firmly as do the pillars of education. But, just as physical building materials have changed from inflexible concrete and stone to flexible plastics, wood and steel, so must policy often change. Policy, as all the other materials, must be a flexible document that is designed to be responsive to changing conditions. Accordingly, it must be frequently reviewed and updated so that it becomes a tool that serves to reinforce appropriate goals or objectives and not a specific yardstick that defines and restricts direction.

CHANGING CONDITIONS

Anyone today considering the housing needs of a college or university can easily be entrapped by thinking in terms of the past, i.e., purely historical patterns as related to numbers of students, student attitudes, and the conditions that have prevailed on campus. These factors are changing rapidly - especially student attitudes and conditions of dormitory life. Generally speaking, dormitory life connotes rules and discipline which seem to be more and more of an enigma to the students. It is becoming increasingly more difficult to satisfy student requirements with conventional type dormitories. In short, future requirements for housing must be attuned to changing desires and conditions.

LEAD TIME

Another factor, which is considered essential to the planning of any construction, is the requirement for lead time. This is the factor that allows an institution to have additional housing when it is needed, not two or three years after the requirement appears. All of these volumes on planning guidelines have been principally directed toward the realization of this factor.

STUDY GUIDELINES

There is obviously a considerable amount of information that must be generated in developing a housing program. This information is an output of the three major phases of the planning system (management and program planning, physical plant planning, and financial planning). Ideally, the housing study is merely a specific application of the planning system where relevant information is generated and then merged into an appropriate product.

RELATION TO PLANNING SYSTEM

The management phase, as illustrated in Volume I and detailed in Volume II, established the administrative and academic directives. Implicit in such an effort is the development of goals, objectives and policies as well as the generation of enrollment data, faculty-staff data, and curriculum emphasis, that affect the management of an institution. As a result of these studies, relevant inputs to the housing study can be readily isolated and applied.

The physical plant planning phase is concerned with land use planning, traffic planning, utilities planning, and facilities planning. Again, relevant inputs into the housing study can be derived from these planning studies. Existing campus land uses must be thoroughly reviewed as well as those proposed for the future. This would include an analysis of available lands in order to determine the most appropriate areas for residential housing additions. The effect of circulation (both pedestrian and automotive) and utilities and the most probable decisions relative to the expansion of these facilities will also produce a considerable effect upon residential housing decisions.

The financial picture poses a major force upon the resolution of a housing program. Plans for housing must be well aligned with the financial plans and capabilities of the institution. "College housing is big business and paying for it is rapidly becoming an exercise in high finance".[3] Construction costs frequently exert a heavy burden on the college economy. Borrowed money frequently contributes to the financing program and residential housing must consequently provide the necessary returns to retire the debts. Coupled with the construction costs are annual operating costs which are very significant. "How well these housing ventures are managed financially directly affects the financing of additional housing, not only by the individual college but by all colleges."[4]

In addition to the inputs that should be readily generated from complementary studies, there are further studies that must be pursued. These cover a survey of existing facilities, a review of the needs for adequate accommodations and a comparison of projected housing demands with existing policies.

SURVEY OF EXISTING HOUSING

A survey of existing housing must include both on-campus and off-campus facilities. On-campus facilities are most frequently dormitories and married student quarters. Obviously, there would be very little trouble in determining their location and the total number of units available. In addition to this information, it is essential to examine the condition of the housing in order to approximate its life and worth. Rental prices must also be recorded as well as services such as food, recreation, etc., that are offered.

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[3] *Ibid.*, page 107.

[4] *Loc. cit.*

The off-campus facilities are more difficult to record. If there is a campus housing office this information may already be assimilated and available. However, most frequently this information is not available and must be surveyed and mapped manually. It is essential to record; (a) the location of housing facilities, (b) the type of facility, (c) the condition of the facility and, (d) the price paid. If historical as well as current data are available then they may serve as an invaluable tool in determining housing trends as well as anticipating circulation and parking demands. These facilities should be inventoried relative to both student and faculty-staff housing.

REVIEW OF NEEDS FOR ADEQUATE ACCOMMODATIONS

A review of the needs for adequate accommodations is concerned with establishing housing standards that must be met in providing new facilities or improving old ones. At this point it is again crucial to recognize the different types of occupants and respond to their differing needs. For example, a single student in a dormitory would have considerably different spatial, social, and service, needs than a married student and family. This distinction is even apparent between a dormitory unit for single males and a dormitory unit for single females. This analysis should include off-campus as well as on-campus facilities. It is essential that the university establish a cooperative rapport with the community so that some controls can be exerted, even if only through recommendations.

Provided in the appendix of this volume are charts which illustrate information that will present further guidance in making decisions relative to student housing. It must be emphasized, however, that this information is subject to change and should be used only as a general guideline. It is included with the intent of providing "ballpark" aids in familiarizing oneself with housing considerations. The charts included are:

1. Space Per Student in Existing Housing Units
2. Check Lists for Projecting Gross Square Footage Requirements for On-Campus Housing
3. Gross Area Per Student by Housing Component
4. Distribution of Gross Area by Housing Component
5. Area Allocation by Type of Space and Capacity
6. Allocation of Construction Cost

DEMAND ANALYSIS

It was mentioned previously that the management studies (Volume II) will contribute data useful in determining the generation of housing demands. This information should be placed in a form that can be readily utilized in a housing survey as the data must be evaluated in relation to the institutions policies on housing. Before discussing this relationship to policy, it is in order to first examine the form of the housing demand data that is required. An adequate projection of the total university enrollment is the obvious starting point. This projection would relate to some predetermined future period of time that is aligned with the other planning studies and is derived from the management studies.

If projection variables are anticipated, which is frequently the case, then alternate studies accounting for the variables would be recommended. The projected enrollment(s) is then broken down into graduate and undergraduate components. It is also advisable to further distinguish among undergraduates between lowerclassmen (freshmen and sophomores) and upperclassmen (juniors and seniors). These distinctions are necessary because of the frequent relationship of these categories to current housing policies or to future policies that may arise when housing demand is compared to supply. In addition to making academic distinctions among students, it is also necessary to record relevant personal distinctions. This would include the total married students at the different academic levels and the sex of the remaining body of single students. This might be recorded in both numbers and percentages. The percentages would be a guide in planning for future projections (and would be based upon a consideration of historical, current and anticipated trends). The actual numbers would relate to making specific housing decisions either at present or in the future.

RELATION TO POLICY

Now that user distinctions have been recorded, it is still necessary to go one step further and relate the user distinctions to locational distinctions (on-campus, off-campus). It is at this point that the role of housing policy becomes significant. Most institutions have policies that state the housing requirements for a particular campus. These policies are generally based upon the existing on-campus housing supply and/or the anticipated future supply. The question must be posed, however, if such a supply oriented policy actually meets the needs of those housed. At this point other policy directives must be either reviewed or established. These relate to such things as the academic, social, and economic functions of housing. It must be determined if housing will play a role in the objectives of the academic program and if housing income is used to supplement the income of the university or if the intent is to simply break even. Once these policy functions have been thoroughly reviewed and directives have been established, decisions can be appropriately made regarding the dispersion of user types and facilities that will be located on-campus and/or off-campus.

SUMMARY

With the input of policy directives, the housing program can be summarized into a form (as illustrated in Figure 13) that defines the direction that will be pursued. Furthermore, it functions as a condensation of relevant information regarding the necessary relationship of user distinctions and locational distinctions. However, it is essential to bear in mind that this format is simply a guideline, or even more appropriately, a point of departure. That which must be responded to is the content and this response will be determined by the needs and demands of the particular institution.

FIGURE 13 · SUMMATION OF HOUSING REQUIREMENTS

Date:

Number Utilizing Off-Campus Housing	GRADUATES		UNDERGRADUATES				TOTAL	
			Upper Classmen		Lower Classmen			
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Married Students								
Single Males								
Single Females								
SUB-TOTAL								
Number Utilizing On-Campus Housing								
Married Students								
Single Males								
Single Females								
SUB-TOTAL								
TOTAL								

The flexibility that exists in the approach to providing residential housing has been well stated by Richard Dober as follows:

> "Against the background of availability and adequacy of future housing supplies and educational and social goals, a two-part program can be arranged: housing to be constructed by the institution itself; and housing which the institution would encourage others to provide. The encouragement may take the form of participation in urban renewal, joint ventures in non-profit, cooperative or limited dividend housing, the provision of credit or land for construction, or simply making known to private enterprise the extent of its housing needs off-campus."[5]

It is apparent that higher educational institutions can ill-afford to take a one-sided or partial approach to anticipating future facility demands. It is hoped that the information presented in this volume will contribute to the realization of a balanced facilities plan which recognizes the institutions role and responsibility in planning for both academic and housing facilities.

Figure 14 on the opposite page provides a graphical summation of the study process that has been discussed in this section.

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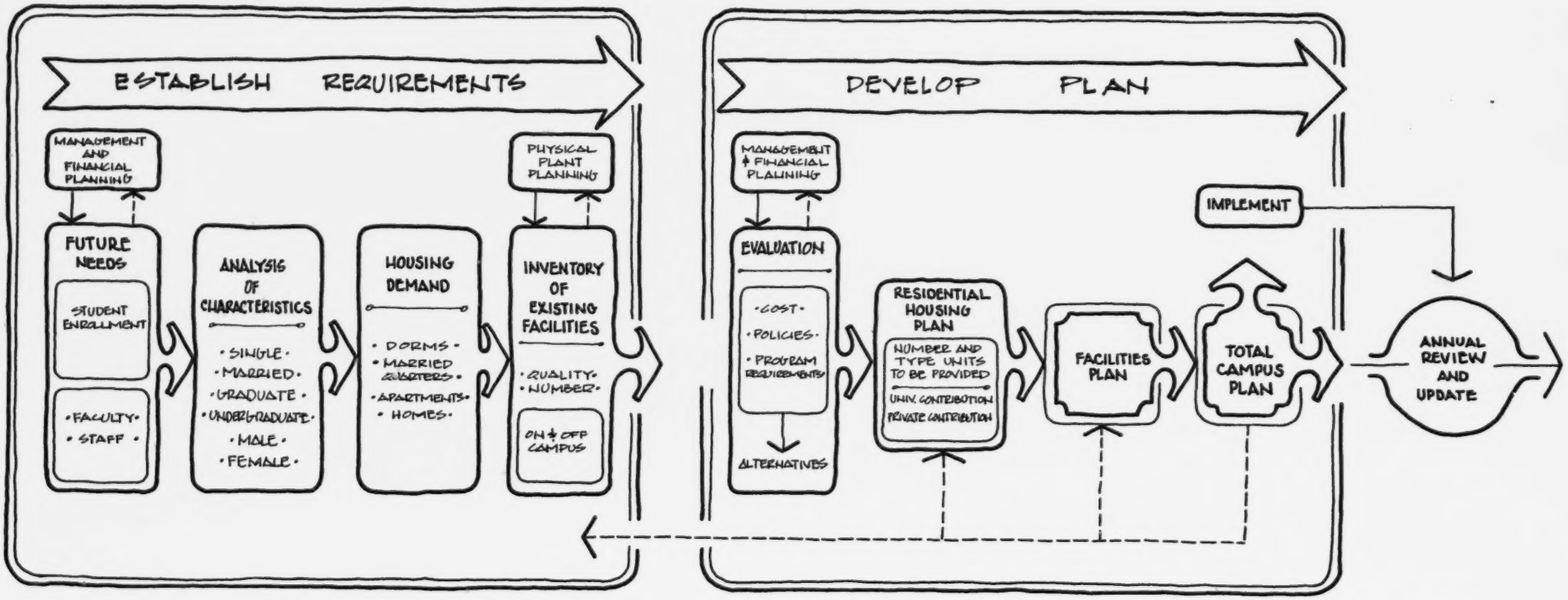
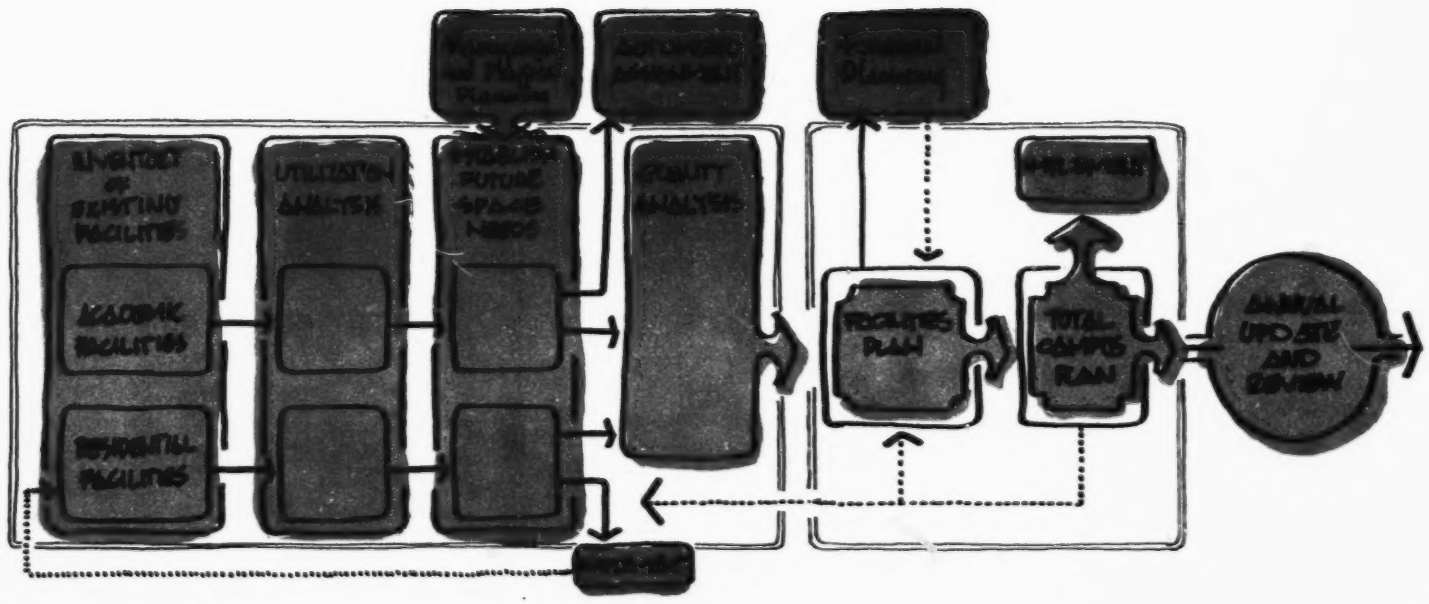
[5]Richard P. Dober, *Campus Planning*, Reinhold Publishing Corp., 1963, p. 136.

FIGURE 14 RESIDENTIAL HOUSING PLANNING PROCESS



FACILITIES PLANNING SYSTEM



It is now possible to summarize the total process that has been suggested for facilities planning by referring again to Figure 1 which graphically illustrates the total system. The major steps in this process have been discussed in the previous material of this volume and Figure 1 illustrates the logical flow of the planning process.

The facilities planning process is designed to provide answers to a series of simple but important questions. These questions asked relative to an institution are as follows:

(1) What Facilities Are Available At The Present Time? (Facilities Inventory)
(2) How Well Are Existing Facilities Being Utilized? (Utilization of Teaching and Non-Teaching Facilities, Residential Housing Study)
(3) What Is The Condition Of Existing Facilities? (Quality Analysis, Residential Housing Study)
(4) What Are Future Facility Requirements? (Estimation of Space Requirements, Residential Housing Study)
(5) How Will Future Requirements For Facilities Be Provided?

The answers to questions numbers 1-4 provide basic data from which to establish requirements. The answer to question number 5 requires an analysis of the basic data and the development of a complete facilities plan. This plan will probably contain all of the following items:

(1) Development of procedures to improve the utilization of existing facilities.
(2) Development of a remodeling program to upgrade the quality of existing space.
(3) Development of plans for requesting assistance from private industry relative to residential housing.
(4) Development of plans to add new facilities.

This facilities plan must be projected a minimum of ten years into the future and should be integrated into the total campus plan. The final step is one of annually reviewing the plan and updating it as necessary to keep it in tune with changing conditions.

APPENDIX

Quality Analysis Worksheets	A-1 • A-18
Housing Guidelines	A-19 • A-24

BUILDING QUALITY ANALYSIS RECORD

Building Name _____

Building Number _____

Building Use Code _____

Building Location _____

Other Information:

Year Built _____

Cost _____

Evaluation No. 1

Date _____ Rating _____

Rating Official _____

Inspector _____

Action Recommended _____

_____

Action Taken _____

_____

Evaluation No. 2

Date _____ Rating _____

Rating Official _____

Inspector _____

Action Recommended _____

_____

Action Taken _____

_____

Evaluation No. 3

Date _____ Rating _____

Rating Official _____

Inspector _____

Action Recommended _____

_____

Action Taken _____

_____

BUILDING EVALUATION SUMMARY

	RATINGS	
	Possible	Actual
I. PRIMARY STRUCTURE		
A. Foundation	14	
B. Wall System	14	
C. Floor System	8	
D. Roof System	8	
II. SECONDARY STRUCTURE		
A. Ceiling System	4	
B. Interior Walls and Partitions	4	
C. Window System	2	
D. Door System	2	
III. SERVICE SYSTEMS		
A. Cooling System	6	
B. Heating System	6	
C. Plumbing System	6	
D. Electrical System	6	
IV. FUNCTIONAL STANDARDS		
A. Assignable Space	4	
B. Adaptability	4	
C. Suitability	4	
V. SAFETY STANDARDS	8	
TOTAL	100	

I. 1. PRIMARY STRUCTURE • FOUNDATION

RATING

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Cracked slab	Slab dropped at corners or center	Inadequate soil conditions	Inadequate footings	
(1) Slab on fill with interior and exterior beams					
(2) Pier and spot footings with slab on fill					
(3) Pier and spot footings with suspended slab					
(4) Piling					
(5) Continuous footing					
(6) Others					

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ____
- . Yes (-1) ____
- . Correction is easy (repair) (-2) ____
- . Correction is difficult (alter) (-5) ____
- . Correction is impossible (-9) ____

TOTAL ____

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 14

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{14 \text{ X }}{10}$$

$$= _____$$

I. 2. PRIMARY STRUCTURE · WALL SYSTEM

APPARENT PROBLEMS INVENTORY OF TYPES:	Broken or cracked	Out of plumb or warped	Rotting or deteriorating	Excessive maintenance	
(1) Structural: Reinforced concrete Structural metal Structural wood Load-bearing masonry					
(2) Non-Structural: (Circle type) Masonry-Brick, Limestone, Concrete Block, Granite, Marble, Other. Curtain or Panel Wall-Metal, Glass, Asbestos Cement, Porcelain Enamel, Other. Exterior Sidings-Wood, Aluminum, Asbestos, Other.					

COMMENTS:

RATING

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 14

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{14 \text{ X }}{10}$$

$$= \frac{\quad}{10}$$

I. 3. PRIMARY STRUCTURE • FLOOR SYSTEM

RATING

INVENTORY OF TYPES:	APPARENT PROBLEMS: Inadequate strength and durability	Deteriorating or rotting	Danger to occupants	Excessive maintenance problems	
(1) Structural					
Reinforced concrete slab and beam					
Structural steel					
Wood joists with deck					
(2) Covering or Finish					
Asphalt tile					
Vinyl tile					
Terrazzo					
Wood					

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 8

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{8 \text{ X }}{10}$$

$$= ____$$

COMMENTS:

I. 4. PRIMARY STRUCTURE • ROOF SYSTEM

RATING

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Deteriorating	Inadequate Strength	Inadequate Insulator	Excessive Maintenance	
(1) Structural					
Reinforced con concrete slab and beam					
Structural steel					
Wood joists or truss					
(2) Decking					
Reinforced concrete slab					
Precast concrete slab					
Metal deck					
Wood deck					
(3) Material					
Built-up (gravel, tar, etc.)					
Composition (shingle)					
Composition rolled					
Asbestos					

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 8

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{8 \text{ X }}{10}$$

$$= ____$$

COMMENTS:

II. 1. SECONDARY STRUCTURE · CEILING SYSTEM

RATING _____

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Deteriorating	Inadequate height equipment clearance, etc.	Cracking--sagging	Excessive maintenance			
Acoustical tile over other materials							
Acoustical tile - suspended							
Sheetrock							
Plaster							
Exposed structural system							

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ____
- . Yes (-1) ____
- . Correction is easy (repair) (-2) ____
- . Correction is difficult (alter) (-5) ____
- . Correction is impossible (-9) ____

TOTAL ____

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 4

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{4 \text{ X }}{10}$$

$$= ____$$

COMMENTS:

II. 2. SECONDARY STRUCTURE · INTERIOR WALLS AND PARTITIONS

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Inadequate acoustical qualities	Lack strength and stability	Lack adaptability	Inadequate appearance	Excessive maintenance		
Metal Stud							
Wood Stud							
Plaster							
Dry Wall							
Exposed Masonry							

COMMENTS:

RATING

POINT EVALUATION:

(1) Are Corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 4

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{4 \text{ X }}{10}$$

$$= ____$$

II. 3. SECONDARY STRUCTURE · WINDOW SYSTEM

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Inadequate functioning	Obsolescence	Framing deterioration	Excessive maintenance			
Aluminum							
Steel							
Wood							

COMMENTS:

RATING

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0)
- . Yes (-1)
- . Correction is easy (repair) (-2)
- . Correction is difficult (alter) (-5)
- . Correction is impossible (-9)

TOTAL

CONDITION VALUE = 10-Total =

(2) FIXED VALUE: 2

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{2 \text{ X }}{10}$$

$$= ____$$

II. 4. SECONDARY STRUCTURE • DOOR SYSTEM

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Inadequate functioning	Obsolescence	Inadequate hardware	Excessive maintenance			
Metal							
Wood							
Glass							
Hollow core							
Solid core							

COMMENTS:

RATING

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ____
- . Yes (-1) ____
- . Correction is easy (repair) (-2) ____
- . Correction is difficult (alter) (5) ____
- . Correction is impossible (-9) ____

TOTAL ____

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 2

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{2 \text{ X }}{10}$$

= _____

III. 1. SERVICE SYSTEMS · COOLING SYSTEM

APPARENT PROBLEMS: / INVENTORY OF TYPES	Inadequate cooling capacity	Inadequate air circulation--improper ventilation	Lack uniform temperature and distribution control	Obsolescence	Excessive maintenance		
None--No cooling system							
All-Air system							
Air-Water system							
Refrigerant system							

COMMENTS:

RATING

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 6

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{6 \text{ X }}{10}$$

$$= ____$$

III. 2. SERVICE SYSTEMS · HEATING SYSTEM

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Inadequate heating capacity	Inadequate ventilation--circulation	Lacks uniform temperature and distribution control	Obsolescence	Excessive maintenance	
Steam Circulating hot water Warm air furnace Space heaters						

COMMENTS:

RATING

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0)
- . Yes (-1)
- . Correction is easy (repair) (-2)
- . Correction is difficult (alter) (-5)
- . Correction is impossible (-9)

TOTAL

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 6

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{6 \text{ X }}{10}$$

$$= ____$$

III. 3. SERVICE SYSTEMS · PLUMBING SYSTEM

APPARENT PROBLEMS: / CONSIDERATIONS:	Inadequate water lines--size, connections, etc.	Inadequate gas lines--size, connections, etc.	Inadequate shut-off valves	Insufficient clean-out system	Back siphonage--cross connections	Obsolescence			Inadequate number of water closets and lavatories	Inadequate fixture installation	Inadequate facilities for women	Obsolescence	Excessive maintenance	Unsanitary					RATING
(1) Piping System Analysis																			
(2) Fixture Analysis																			

COMMENTS:

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0)
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___
- TOTAL ___
- CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 6

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{6 \text{ X }}{10}$$

$$= ____$$

III. 4. SERVICE SYSTEMS · ELECTRICAL SYSTEM

APPARENT PROBLEMS: / INVENTORY OF TYPES:	Inadequate wiring system	Excessive collected load	Inadequate switchgear	Inadequate circuits	Obsolescence	Inadequate number of outlets			Inadequate lighting environment	Inadequate exit and hall lighting	Inadequate fixtures	Obsolescence	Excessive maintenance										
(1) Power																							
High voltage																							
Low voltage																							
(2) Lighting																							
Incandescent																							
Flourescent																							
Mercury vapor																							

RATING

COMMENTS

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ____
- . Yes (-1) ____
- . Correction is easy (repair) (-2) ____
- . Correction is difficult (alter) (-5) ____
- . Correction is impossible (-9) ____

TOTAL ____

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 6

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{6 \text{ X }}{10}$$

$$= ____$$

IV. 1. FUNCTIONAL STANDARDS · ASSIGNABLE SPACE — RATING

(1) Space Inventory:

A. Total Floor Space (all uses)	_____	Sq. Ft.
B. Assignable Space (offices, labs, classrooms, etc.)	_____	Sq. Ft.
C. Assignable Space Ratio ($\frac{B}{A}$)	_____	%

COMMENTS:

(3) POINT EVALUATION:

A. This building s assignable space ratio is:
- . Optimum for this Facility Type
- . Adequate for this Facility Type
- . Fair for this Facility Type
- . Poor for this Facility Type
- . Bad for this Facility Type

CONDITION VALUE = 10 minus total points = ____

B. FIXED VALUE: 4

C. Assignable Rating = FIXED VALUE X CONDITION VALUE = $\frac{4 \text{ X }}{10}$

= _____

IV. 2. FUNCTIONAL STANDARDS · ADAPTABILITY

RATING

APPARENT PROBLEMS:

____ Inflexible building use--example (dormitory, biology or other, designed for a specific use).
____ Inflexible student seating
____ Rigid partitions
____ Stationary equipment
____ Other
____ _____
____ _____
____ _____

COMMENTS:

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ____
- . Yes (-1) ____
- . Correction is easy (repair) (-2) ____
- . Correction is difficult (alter) (-5) ____
- . Correction is impossible (-9) ____

TOTAL ____

CONDITION VALUE = 10-Total = ____

(2) FIXED VALUE: 4

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{4 \text{ X}}{10}$$

= _____

IV. 3. FUNCTIONAL STANDARDS • SUITABILITY

RATING

APPARENT PROBLEMS:

_____ Undesirable working environment
_____ Undesirable educational spaces
_____ Undesirable circulation patterns, arrangement of educational spaces, etc.
_____ Conflicting uses
_____ Others
_____ _____
_____ _____
_____ _____

COMMENTS:

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) ___
- . Yes (-1) ___
- . Correction is easy (repair) (-2) ___
- . Correction is difficult (alter) (-5) ___
- . Correction is impossible (-9) ___

TOTAL ___

CONDITION VALUE = 10-Total = ___

(2) FIXED VALUE: 4

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{4 \text{ X }}{10}$$

$$= \frac{\quad}{\quad}$$

V. SAFETY STANDARDS

APPARENT PROBLEMS:

_____ Inadequate stairs--combustible, deteriorating, etc.
_____ Inadequate fire escape system
_____ Lacking sprinkler system in hazardous areas
_____ Lacking independent electrical supply for fire alarm
_____ Obsolete elevator system
_____ Others (List)
_____ _____
_____ _____
_____ _____

COMMENTS:

POINT EVALUATION:

(1) Are corrective measures needed?
- . No (-0) _____
- . Yes (-1) _____
- . Correction is easy (repair) (-2) _____
- . Correction is difficult (alter) (-5) _____
- . Correction is impossible (-9) _____

TOTAL _____

CONDITION VALUE = 10-Total = _____

(2) FIXED VALUE: 8

(3) FOUNDATION RATING:

$$= \frac{\text{FIXED VALUE X CONDITION VALUE}}{10}$$

$$= \frac{8 \text{ X }}{10}$$

= _____

TABLE I:

SPACE PER STUDENT IN EXISTING HOUSING UNITS[1]

Housing Type	Average Gross Area per Student or Apartment
Single Men	212.7 sq. ft.
Single Women	253.4
Combined Average	230.8
Married Students	667.2
Combined Average All Students	268.7
Faculty	693.9

NOTE: Combined averages are weighed for relative numbers of men and women, single and married students.

[1]Harold C. Riker, *College Students Live Here*, New York: Educational Facilities Laboratories, Inc., 1966, p.93.

TABLE 2:

CHECK LISTS FOR PROJECTING GROSS SQUARE FOOTAGE REQUIREMENTS FOR ON-CAMPUS HOUSING[2]

Planning Index to Facility Type[a]	Planning Standard Gross Square Footage Per Living Unit[b]
A. Undergraduate Housing	
1. Single Male	212[c]
2. Single Female	253[d]
3. Married Students, no children	360 plus bath[e]
4. Married, with children	680 plus bath[f]
5. Housemothers	600 plus bath[g]
6. Tutors (bachelor)	320 plus bath[h]
B. Graduate And Special	
1. Single Male	212[i]
2. Single Female	253[j]
3. Married, no children	667[k]
4. Married, with children	680 plus bath[f]
C. Faculty	
1. Bachelor	420 plus bath[l]
2. Married, no children	680 plus bath[m]
3. Family Units	760 plus bath[n]
4. Professor Emeriti	760 plus bath[n]
5. Artist in residence	680 plus bath plus studio[m]
D. Administration And Staff	
1. President	Special[o]
2. Deans	Special[p]
3. Chaplain	Special
4. Maintenance Staff and Operations	230 plus bath[q]
5. Visitors	255 plus bath[r]

FOOTNOTES TO TABLE 2:

a. The list does not exhaust all the possibilities, but will assure a balanced coverage.

b. A living unit is defined as the space per user for all uses associated with residential buildings. All square footages are suggested by the author as being minimum for long-range planning purposes. Sources are shown below.

c. Average 230 projects studied by Riker and Lopez.

d. Average 180 projects studied by Riker and Lopez.

e. Minimum space standards for efficiency units under mortgages for general housing purposes administered by Federal Housing Agency.

f. Minimum two-bedroom living unit standards for general housing mortgages administered by Federal Housing Agency.

g. Minimum one-bedroom living unit standards for general housing mortgages administered by Federal Housing Agency.

h. Minimum housing standard for single person under Section 213 Housing Act, 1950, amended (cooperative housing), plus study.

i. No less than single student standards.

j. No less than single student standards.

k. Average standards from projects studied by Riker and Lopez.

l. Minimum standards one-bedroom unit for general housing mortgages administered by Federal Housing Agency plus space for a study.

m. Minimum standards one-bedroom units for general housing mortgages administered by Federal Housing Agency, plus space for a study.

n. (m) above, plus additional bedroom.

o. Requires large spaces for entertaining.

p. Requires large spaces for entertaining, but smaller than o.

q. Minimum standard efficiency unit for single person under mortgages administered by Federal Housing Administration.

r. Double-room size, hotel standards.

[2] Richard P. Dober, *Campus Planning*, Reinhold Publishing Corporation, 1963, p.137.

TABLE 3:

GROSS AREA PER STUDENT BY HOUSING COMPONENT[3]

	MEN				WOMEN			
Components	No. of Projects	Average	High	Low	No. of Projects	Average	High	Low
Study-Bedrooms	105	106.3	148.6	72.3	97	112.2	139.7	83.7
Toilet-Showers	104	14.9	28.2	6.5	97	15.7	31.4	6.2
Corridors-Stairs	76	38.0	61.5	7.8	63	47.9	83.0	23.4
Lounge-Recreation	96	19.3	55.3	3.5	95	23.5	79.8	2.9
Storage-Service-Laundry	67	15.8	46.7	2.6	60	22.3	72.1	6.9
Dining-Kitchen	26	23.6	60.0	14.2	39	28.5	112.8	1.3
Staff Apartments	14	5.1	12.9	1.1	15	7.7	25.0	3.3
Other	91	34.9	180.8	.7	55	16.7	166.1	2.4
TOTAL	230	212.7	838.9	177.5	180	253.4	416.6	172.7

NOTE: The number of projects for each component varies because data were not uniformly prepared or available. For this reason, square footage figures can only be compared by individual component; they do not add up to the total. Information on total space allocation was more readily available-as the number of projects shows. Basic information was collected through the assistunce of the Community Facilities Administration and covers projects constructed or planned, 1955-60.

[3]Harold C. Riker, *College Students Live Here*, New York: Educational Facilities Laboratories, Inc., 1966, p.66.

TABLE 4:

DISTRIBUTION OF GROSS AREA BY HOUSING COMPONENT[4]

	MEN				WOMEN			
Components	Projects	Average	High	Low	Projects	Average	High	Low
Study Bedrooms	105	50.5%	63.7%	26.7%	106	46.1%	71.6%	24.4%
Toilet-Showers	105	6.9	11.1	2.6	106	6.9	15.1	2.5
Corridors-Stairs	105	19.2	25.8	.8	106	19.6	26.8	7.0
Lounge-Recreation	103	8.9	27.2	1.5	105	9.9	25.9	2.2
Storage-Service-Laundry	103	7.7	17.4	1.0	105	8.9	17.8	1.2
Dining-Kitchen	28	13.2	34.7	1.5	43	13.3	28.8	1.5
Staff Apartments	17	2.4	5.2	.3	20	3.3	9.7	1.4
Other	87	3.7	16.1	.1	92	3.9	26.8	.3

NOTE: The number of projects for each component varies because data were not uniformly prepared or available. For this reason, percentages do not total 100 per cent; they can be compared only by individual component. Basic information, collected through the courtesy of the Community Facilities Administration, covers 211 projects constructed or planned, 1955-60.

[4]Harold C. Riker, *College Students Live Here*, New York: Educational Facilities Laboratories, Inc., 1966, p.66.

TABLE 5:

AREA ALLOCATION BY TYPE OF SPACE AND CAPACITY[5]

Capacity of Residence Hall	75 (Women)	150 (Women)	300(Men-(Women)	500 (Men)	1,000 (Women)	1,500 (Men)
1. Study-Bedroom	29.7%	38.1%	46.0%	45.5%	47.5%	45.6%
2. Toilets-Showers	6.6	5.2	6.0	5.3	4.9	6.6
3. Corridors-Stairs	20.9	17.5	19.0	24.6	23.6	18.2
4. Lounge-Recreation	14.8	9.2	6.0	5.7	7.8	7.5
5. Service-Storage	11.9	10.6	4.0	7.1	9.3	12.4
6. Dining-Kitchen	11.5	13.3	15.0	11.3	5.9	7.9
7. Other	4.6	6.1	4.0	.5	1.0	1.8
8. Sum: Items 4,5,6,7	(42.8)	(39.2)	(29.0)	(24.6)	(24.0)	(29.6)
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

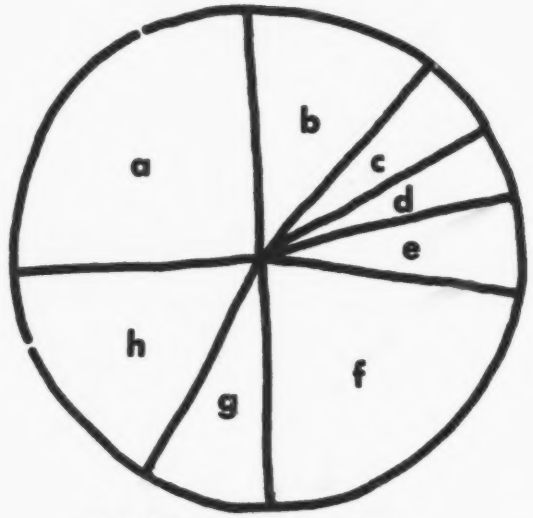
Based on analysis of a limited number of projects selected as representing recent practice.

[5]Harold C. Riker, *College Students Live Here*, New York: Educational Facilities Laboratories, Inc., 1966, p.34.

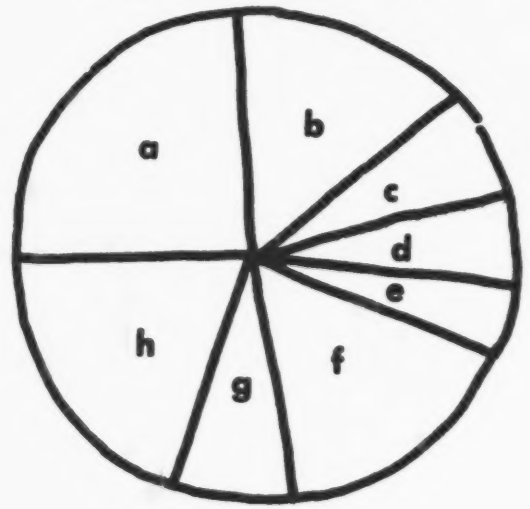
TABLE 6:

ALLOCATION OF CONSTRUCTION COST[6]

CONVENTIONAL		HIGH-RISE
1.7%	General	1.4%
1.7%	Excavating & Grading	0.85%
25.5%	Structural Frame	24%
12%	Masonry & Stone (WP&DP)	14%
1.25%	Roofing & Sheet Metal	1%
1.75%	Misc. & Ornamental Iron	3%
4.35%	Carpentry & Millwork	7.75%
1.75%	Metal Doors & Frames	0.82%
4%	Windows, Glass, Glazing	4.5%
6%	Tile, Marble & Terrazzo	4%
2%	Lathing & Plaster	5.5%
0.75%	Acoustic Tile	0.7%
1%	Composition Flooring	0.88%
2.25%	Painting & Caulking	1.9%
1%	Finish Hardware	1%
1.5%	Elevators & Dumbwaiters	5%
22%	Mech. Equip. + Food Equip.	16%
8.5%	Electrical	7%
1%	Miscellaneous	0.7%



CONVENTIONAL



HIGH - RISE

a - STRUCTURAL FRAME

b - MASONRY AND STONE

c - CARPENTRY AND MILLWORK

d - WINDOWS, GLASS, GLAZING

e - TILE, MARBLE AND TERRAZZO

f - MECH. EQUIP.+ FOOD EQUIP.

g - ELECTRICAL

h - MISCELLANEOUS

Figures indicate percent of total construction cost allocated to various contract categories for two buildings of comparable size and quality at the same institution.

[6]Harold C. Riker, *College Students Live Here*, New York: Educational Facilities Laboratories, Inc., 1966, p.35.

ADDITIONAL VOLUMES

The following outlines describe the additional volumes in the series on Planning Guidelines:

VOLUME I - PLANNING SYSTEM

I. Introduction
   - A. Background
   - B. Planning Requirements
   - C. Project Scope
   - D. Project Organization
   - E. Project Presentation
   - F. Time Span
   - G. Community Considerations

II. Management and Program Planning
   - A. University Objectives
   - B. Program Plans and Requirements
   - C. Planning Report • Academic Departments
   - D. College Summary
   - E. Planning Report • Research and Public Service and/or Extension
   - F. Planning Report • Support Organizations
   - G. University Summary

III. Physical Plant Planning
   - A. Facilities Planning
   - B. Traffic Planning
   - C. Utilities Planning
   - D. Land Use Planning
   - E. Physical Plant Planning Process

IV. Financial Planning
   - A. Multi-Year Budgets
   - B. Financial Evaluation
   - C. Cost Estimation
   - D. Income Estimation
   - E. Planning-Programming-Budgeting

V. Total University Plan

VI. Continuous Planning System
   - A. Dynamic Planning
   - B. Organization

VII. Summary

VOLUME II - MANAGEMENT AND FINANCIAL PLANNING

I. Introduction
   A. Planning System
   B. Management and Program Planning
   C. Financial Planning
   D. Organization for Planning
II. Institutional Objectives
   A. Fact-Finding Study
   B. Preliminary Objectives
   C. Review and Modifications
III. Organizational Unit Plans
   A. Program Units
   B. Support Units
IV. Planning Report - Program Implementation Units
   A. Format
   B. Historical Section
   C. Projections
   D. Program Requirements
V. Planning Report - Program Support Units
VI. Management and Program Planning Summary
VII. Organization for Planning
   A. Basic Considerations
   B. Development of Planning Organization
   C. Staffing of Planning Organization
VIII. Cost Model
IX. Income Model
X. Planning-Programming-Budgeting
   A. Definition
   B. Program Concept
   C. Program Requirements
   D. Resource Allocation

VOLUME III - PHYSICAL PLANT PLANNING • LAND USE AND TRAFFIC

I. Introduction
   A. Land Use
   B. Traffic

LAND USE PLANNING SECTION

II. Introduction

III. Basic Determinants - Information Inputs
   A. Management
   B. Financial
   C. Physical

IV. Basic Determinants - Investigation, Analysis and Program Development
   A. Problem Identification
   B. Planning Assumptions

V. Design Factors - Evaluation, Testing and Selection
   A. Tangible Design Factors
   B. Intangible Design Factors

VI. Land Use Plan - Synthesis
   A. Land Use Scales
   B. Land Use Alternatives
   C. Land Use Plan

VII. Detail Design and Implementation

VIII. Continuing Planning

TRAFFIC PLANNING SECTION

IX. Introduction
   A. Conditions
   B. Basic Elements

X. Access
   A. Street System Inventory
   B. Traffic Characteristics
   C. Traffic Assignment

XI. Internal Circulation
   A. Street Inventory
   B. Characteristics of Pedestrian Movement

XII. Parking
   A. Supply Inventory
   B. Characteristics Study
   C. Future Types

XIII. Special Events
   A. Attendance
   B. Routing
   C. Control Coordination

XIV. Traffic Plan
   A. Analysis of Results
   B. Construction of Facilities
   C. Control Plan

VOLUME V - PHYSICAL PLANT PLANNING · UTILITY STUDIES

I. Introduction

II. Energy Utilities
- A. Chilled Water
- B. Water Heating Systems
- C. Steam
- D. Condenser Water
- E. Electric Lighting and Power

III. Distribution Systems
- A. Central Utilities Plant
- B. Central Plant Distribution Systems
- C. Controls for Central Utilities Plants
- D. Total Energy Plants

IV. Service Utilities
- A. Water
- B. Sewerage System
- C. Surface Drainage
- D. Domestic Hot Water
- E. Compressed Air

V. Communication Systems
- A. Telephone Systems
- B. Telegraph
- C. Radio
- D. Pneumatic Tube Systems
- E. Clock and Signal Systems
- F. Data Reclaim Systems

VI. Summary